RAJALAKSHMI ENGINEERING COLLEGE

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Department of Computer Science and Engineering

CS23334 Fundamentals of Data Science Lab

III semester II Year (2023R)

Name of the Student :PRAGADEESH S

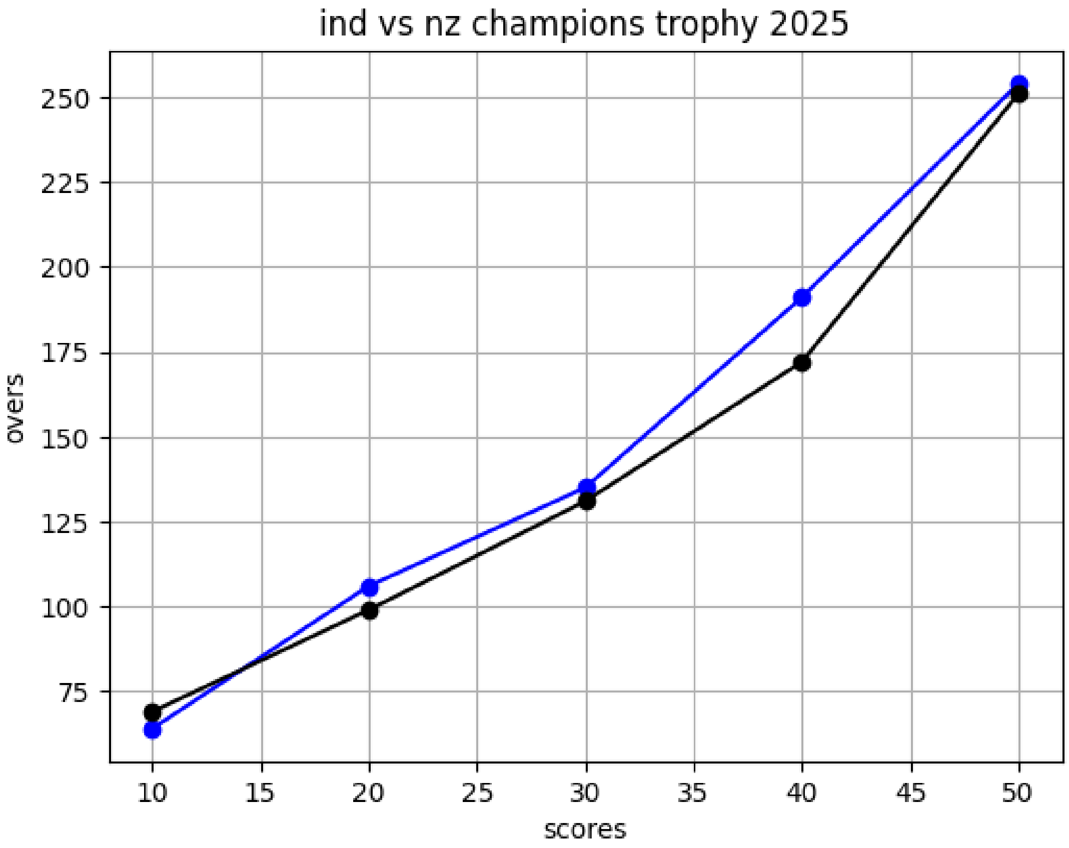
Register Number : 240701388

nnjusjhrr

November 18, 2025

[8]:

```
from matplotlib import pyplot as plt
overs=[10,20,30,40,50]
india=[64,106,135,191,254]
nz=[69,99,131,172,251]
plt.plot(overs,india,color='b',marker='o')
plt.plot(overs,nz,color='black',marker='o')
plt.xlabel("scores")
plt.ylabel("overs")
plt.title("ind vs nz champions trophy 2025")
plt.grid(True)
plt.show()
```



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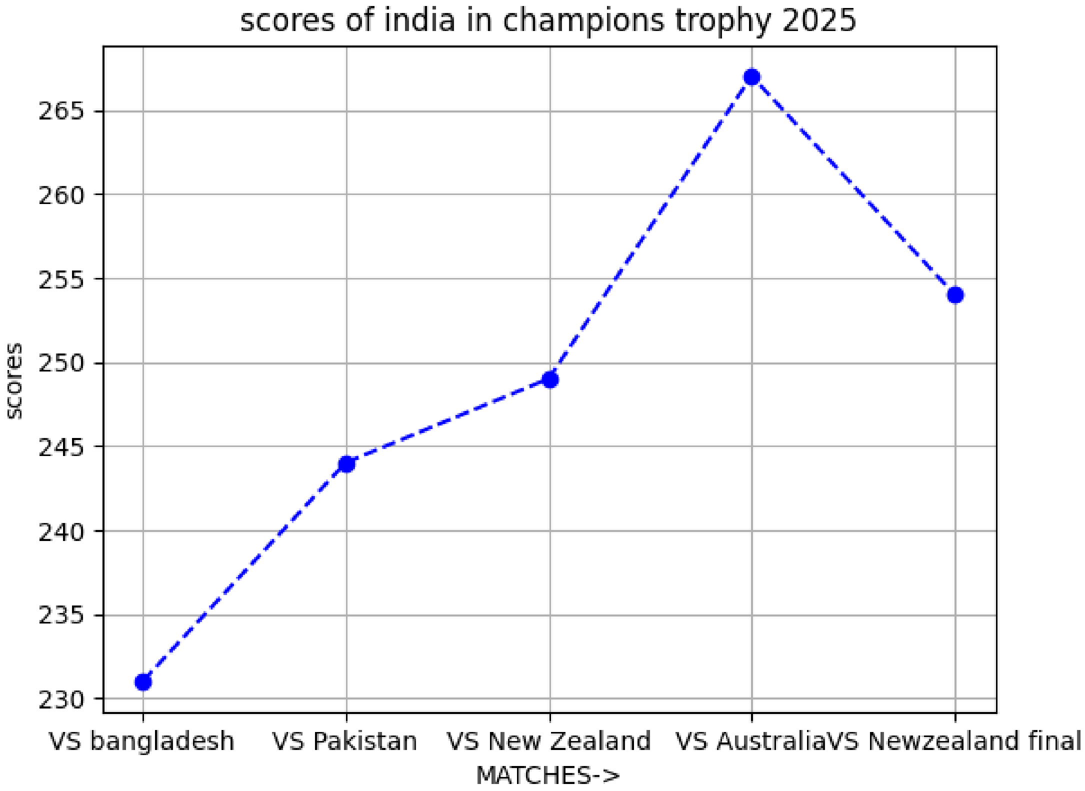
[ ]:

ipaczigq7

November 18, 2025

[15]:
```
from matplotlib import pyplot as plt
matches=['VS bangladesh','VS Pakistan','VS New Zealand','VS Australia','VS␣
 ↪Newzealand final']
scores=[231,244,249,267,254]
plt.plot(matches,scores,color='b',marker='o',linestyle='--')
plt.title("scores of india in champions trophy 2025")
plt.xlabel("MATCHES->")
plt.ylabel("scores")
plt.grid(True)
plt.show()
```



[ ]:

```
```

exp1c

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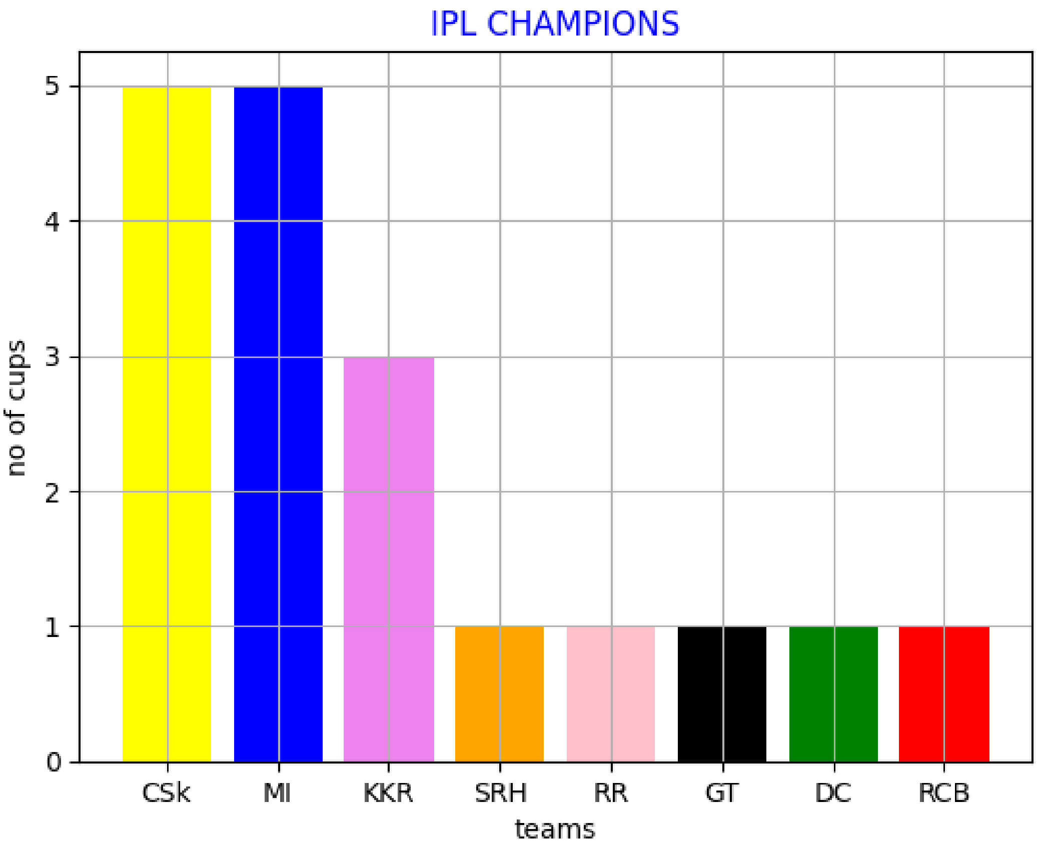
[3]:

```
from matplotlib import pyplot as plt
ipl={'CSk':5,'MI':5,'KKR':3,'SRH':1,'RR':1,'GT':1,'DC':1,'RCB':1}
cups=list(ipl.values())
teams=list(ipl.keys())
colors=['yellow','blue','violet','orange','pink','black','green','red']
plt.bar(teams,cups,color=colors)
plt.title("IPL CHAMPIONS",color='b')
plt.xlabel("teams")
plt.ylabel("no of cups")
plt.grid(True)
plt.show()
```



2

[ ]:

exp1d

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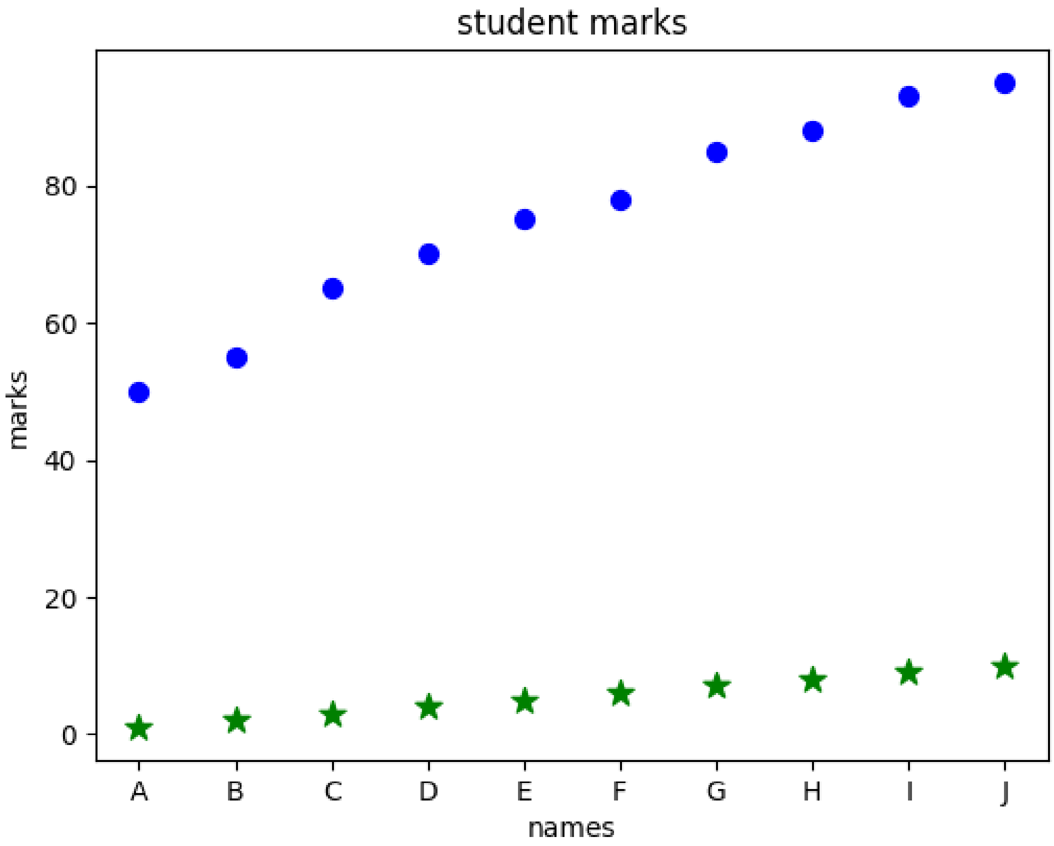
[8]:

```
from matplotlib import pyplot as plt

student_data = {
    'A': (1, 50),
    'B': (2, 55),
    'C': (3, 65),
    'D': (4, 70),
    'E': (5, 75),
    'F': (6, 78),
    'G': (7, 85),
    'H': (8, 88),
    'I': (9, 93),
    'J': (10, 95)
}
students=list(student_data.keys())
hours=[value[0] for value in student_data.values()]
marks=[value[1] for value in student_data.values()]


plt.scatter(students,hours,color='g',marker='*',s=100)
plt.scatter(students,marks,color='b',marker='.',s=200)

plt.xlabel("names")

plt.ylabel("marks")
plt.title("student marks")

plt.show()
```


student marks
marks
0
20
40
60
80
names
A
B
C
D
E
F
G
H
I
J

```
[ ]:
```

exp1e

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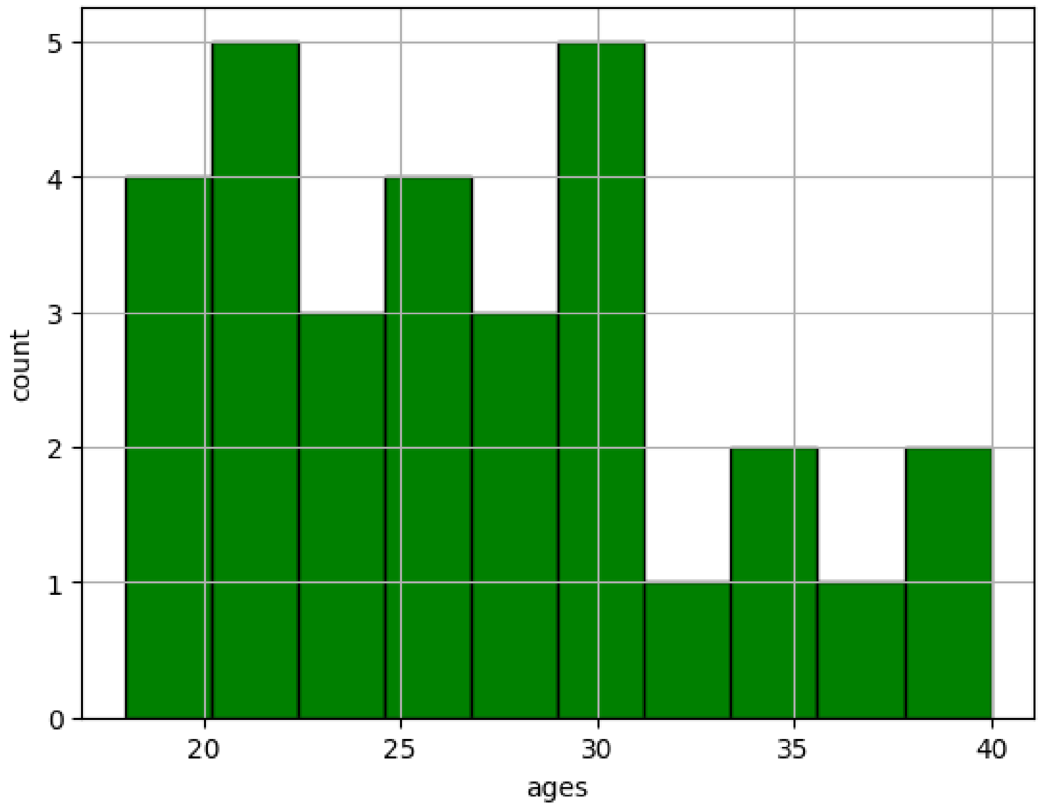
[11]:

```
from matplotlib import pyplot as plt

 ages = [18, 19, 20, 20, 21, 21, 22, 22, 22, 23,
         23, 24, 25, 25, 25, 26, 27, 28, 28, 29,
         30, 30, 30, 31, 32, 34, 35, 36, 38, 40]

plt.hist(ages,color='g',bins=10,edgecolor='black')
plt.xlabel("ages")
plt.ylabel("count")
plt.grid(True)
plt.show()
```



[ ]:

exp1f

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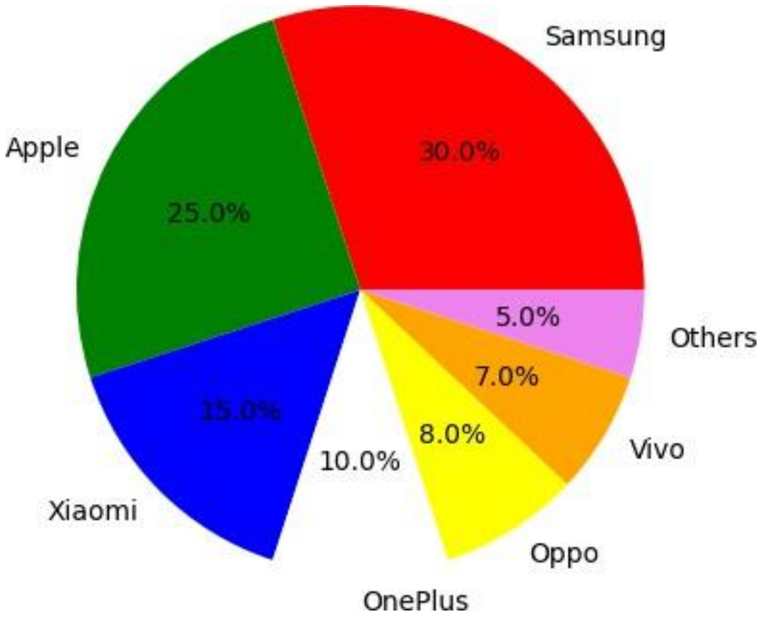
[17]:

```
from matplotlib import pyplot as plt

brands = ['Samsung', 'Apple', 'Xiaomi', 'OnePlus', 'Oppo', 'Vivo', 'Others']
market_share = [30, 25, 15, 10, 8, 7, 5]

plt.pie(market_share,labels=brands,autopct='%0.
  1f%%',colors=['red','green','b','w','yellow','orange','violet'])

plt.show()
```



[ ]:

```
```

exp2

November 18, 2025

[4]:

```python
import os
import pandas as pd

import numpy as np

from matplotlib import pyplot as plt

os.chdir("D:\\pandas")

df=pd.read_csv("sales_data.csv")
df.head()
```

[4]:

```
         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
```

[7]:

```python
df.isnull().sum()
```

[7]:

```
Date        0
Product     0
Sales       0
Quantity    0
Region      0
dtype: int64
```

[13]:

```python
df['Sales'].fillna(df['Sales'].mean())
```

[13]:

```
0    200
1    150
2    220
3    300
4    180
5    210
6    320
```

```
7      160
8      230
9      310
10     190
11     240
12     330
13     170
14     250
15     340
Name: Sales, dtype: int64
```

[15]:

```
df.dropna(subset=['Product','Quantity','Region'])
```

[15]:

```
          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
5   06-01-2023  Product A    210         5  North
6   07-01-2023  Product C    320         7   East
7   08-01-2023  Product B    160         3  South
8   09-01-2023  Product A    230         6  North
9   10-01-2023  Product C    310         7   East
10  11-01-2023  Product B    190         4   West
11  12-01-2023  Product A    240         6  North
12  13-01-2023  Product C    330         8   East
13  14-01-2023  Product B    170         3  South
14  15-01-2023  Product A    250         7  North
15  16-01-2023  Product C    340         8   East
```

[16]:

```
df.describe()
```

[16]:

```
            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
```

[18]:

```
product_summary=df.groupby('Product').agg({
    'Sales':'sum',
    'Quantity':'sum'
}).reset_index()
```

```
product_summary
```

[18]:

```
     Product  Sales  Quantity
0  Product A   1350        33
1  Product B    850        17
2  Product C   1600        36
```

[19]:

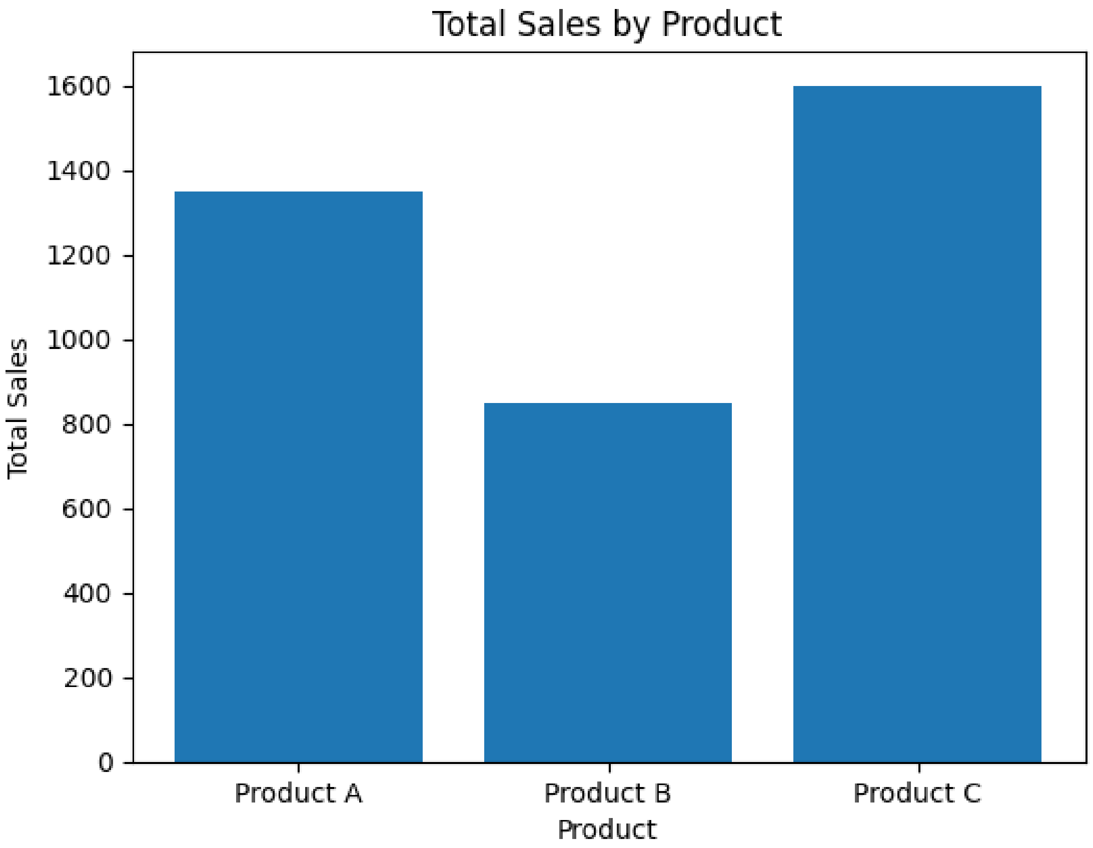
```
plt.figure(figsize=(10,6))
```

[19]:

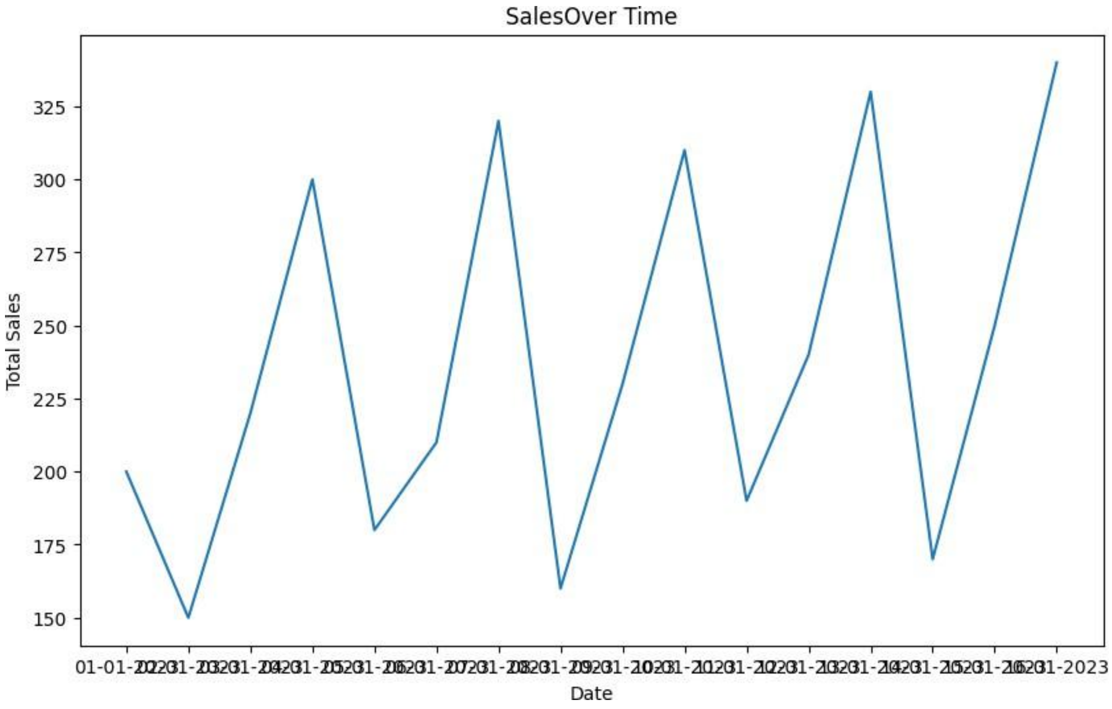
```
<Figure size 1000x600 with 0 Axes>

<Figure size 1000x600 with 0 Axes>
```

[20]:

```
plt.bar(product_summary['Product'], product_summary['Sales'])
plt.xlabel('Product')
plt.ylabel('Total Sales')
plt.title('Total Sales by Product')
plt.show()
```



[22]:
```
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()
```



[29]:
```
pivot_table = df.pivot_table(values='Sales', index='Region', columns='Product',
aggfunc='sum',fill_value=0)

pivot_table
```

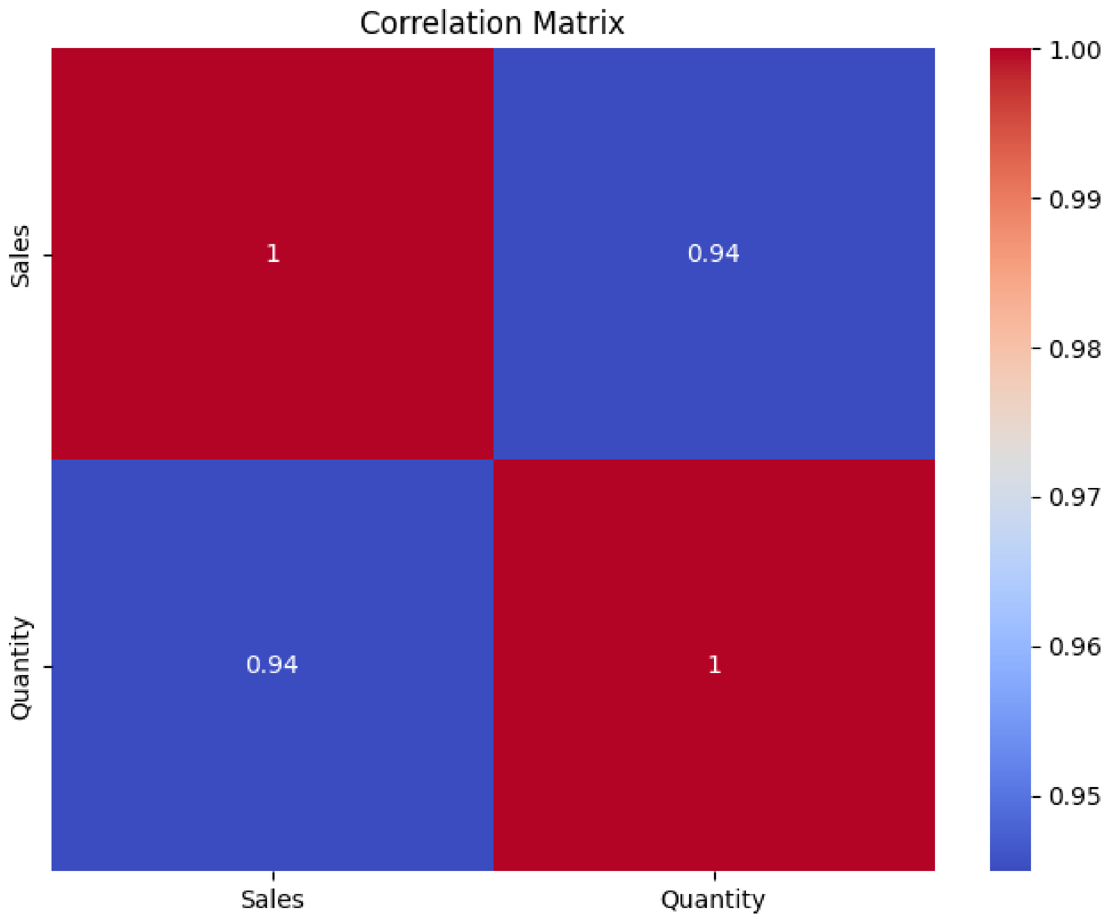
[29]:
```
Product  Product A  Product B  Product C
Region
East             0          0       1600
North         1350          0          0
South            0        480          0
West             0        370          0
```

[37]:
```
df['Date'] = pd.to_datetime(df['Date'],dayfirst=True)
correlation_matrix = df.select_dtypes(include=[float, int]).corr()
print(correlation_matrix)
```

```
             Sales  Quantity
Sales     1.000000  0.944922
Quantity  0.944922  1.000000
```

[38]:

```
import seaborn as sns
plt.figure(figsize=(8, 6))
sns.heatmap(correlation_matrix, annot=True, cmap='coolwarm')
plt.title('Correlation Matrix')
plt.show()
```



[ ]:

exp3

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[2]:

```
import pandas as pd

import numpy as np

import os

os.chdir("D:\\pandas")

df=pd.read_csv("pre_process_datasample.csv")

df
```

[2]:

```
   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
```

[3]:

```
df["Country"].mode()
```

[3] :

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

[4] :

```
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: 452.0+ bytes
```

[5] :
```
df["Country"].mode()[0]
```

[5]:
```
'France'
```

[6]:
```
type(df["Country"].mode()[0])
```

[6]:
```
str
```

[8]:
```
df["Country"].fillna(df["Country"].mode()[0])
```

[8]:
```
0     France
1      Spain
2    Germany
3      Spain
4    Germany
5     France
6      Spain
7     France
8    Germany
9     France
Name: Country, dtype: object
```

[10]:
```
df["Age"].fillna(df["Age"].median())
```

[10]:
```
0    44.0
1    27.0
2    30.0
3    38.0
4    40.0
5    35.0
6    38.0
7    48.0
8    50.0
9    37.0
Name: Age, dtype: float64
```

[48]:
```
df["Salary"].fillna(round(df["Salary"].mean()))
```

[48]:
```
0    72000.0
1    48000.0
2    54000.0
3    61000.0
```

```
4    63778.0
5    58000.0
6    52000.0
7    79000.0
8    83000.0
9    67000.0
Name: Salary, dtype: float64
```

[49]:

```
pd.get_dummies(df.Country)
```

[49]:

```
   France  Germany  Spain
0    True    False  False
1   False    False   True
2   False     True  False
3   False    False   True
4   False     True  False
5    True    False  False
6   False    False   True
7    True    False  False
8   False     True  False
9    True    False  False
```

[50]:

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

[50]:

```
   France  Germany  Spain   Age   Salary Purchased
0    True    False  False  44.0  72000.0        No
1   False    False   True  27.0  48000.0       Yes
2   False     True  False  30.0  54000.0        No
3   False    False   True  38.0  61000.0        No
4   False     True  False  40.0  63778.0       Yes
5    True    False  False  35.0  58000.0       Yes
6   False    False   True   NaN  52000.0        No
7    True    False  False  48.0  79000.0       Yes
8   False     True  False  50.0  83000.0        No
9    True    False  False  37.0  67000.0       Yes
```

[52]:

```
updated_dataset["Purchased"] = updated_dataset["Purchased"].
↪replace(['No','Yes'], [0,1]).astype(int)
```

[53]:

```
updated_dataset
```

[53]:

```
   France  Germany  Spain   Age   Salary  Purchased
0    True    False  False  44.0  72000.0          0
1   False    False   True  27.0  48000.0          1
2   False     True  False  30.0  54000.0          0
```

```
3  False   False   True  38.0  61000.0         0
4  False    True  False  40.0  63778.0         1
5   True   False  False  35.0  58000.0         1
6  False   False   True   NaN  52000.0         0
7   True   False  False  48.0  79000.0         1
8  False    True  False  50.0  83000.0         0
9   True   False  False  37.0  67000.0         1
```

```
[ ]:
```

exp4

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[45]:

```
import numpy as np

import pandas as pd

import os

os.chdir("D:\\pandas")

df=pd.read_csv("Hotel_Dataset.csv")
df
```

[45]:

```
    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  3456
9            9     25-30            2       Ibis        Non-Veg  3456
10          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
9         3           -99999       25-30
10        4            87777       30-35
```

[46]:

```
df.duplicated()
```

[46] :

```
0       False
1       False
2       False
3       False
4       False
5       False
6       False
7       False
8       False
9        True
10      False
dtype: bool
```

[47] :

```
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: 924.0+ bytes
```

[48] :

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

[48]:

```
   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  3456
```

```
10         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
```

[49] :

```
len(df)
```

[49]:

```
10
```

[50] :

```
index=np.array(list(range(0,len(df))))
df.set_index(index)
```

[50]:

```
   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 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
```

[51] :

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

[51]:
```
    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  3456
10          10     30-35            5     RedFox        non-Veg -6755

    NoOfPax  EstimatedSalary
0         2            40000
1         3            59000
2         2            30000
3         2           120000
4         2            45000
5         2           122220
6        -1            21122
7       -10           345673
8         3           -99999
10        4            87777
```

[52]:
```
df.loc[df["CustomerID"] < 0, "CustomerID"] = np.nan
df.loc[df["Bill"] < 0, "Bill"] = np.nan
df.loc[df["EstimatedSalary"]<0,"EstimatedSalary"]=np.nan
df.loc[df["Rating(1-5)"]<0,"Rating(1-5)"]=np.nan






df
```

[52]:
```
    CustomerID Age_Group  Rating(1-5)      Hotel FoodPreference    Bill  \
0          1.0     20-25          4.0       Ibis            veg  1300.0
1          2.0     30-35          5.0  LemonTree        Non-Veg  2000.0
2          3.0     25-30          6.0     RedFox            Veg  1322.0
3          4.0     20-25          NaN  LemonTree            Veg  1234.0
4          5.0       35+          3.0       Ibis     Vegetarian   989.0
5          6.0       35+          3.0       Ibys        Non-Veg  1909.0
6          7.0       35+          4.0     RedFox     Vegetarian  1000.0
7          8.0     20-25          7.0  LemonTree            Veg  2999.0
8          9.0     25-30          2.0       Ibis        Non-Veg  3456.0
10        10.0     30-35          5.0     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
10        4          87777.0
```

[53]:
```
df.Age_Group.unique()
```

[53]:
```
array(['20-25', '30-35', '25-30', '35+'], dtype=object)
```

[54]:
```
df["Hotel"].unique()
```

[54]:
```
array(['Ibis', 'LemonTree', 'RedFox', 'Ibys'], dtype=object)
```

[55]:
```
df.Hotel.replace(['Ibys'],'Ibis')
```

[55]:
```
0          Ibis
1     LemonTree
2        RedFox
3     LemonTree
4          Ibis
5          Ibis
6        RedFox
7     LemonTree
8          Ibis
10       RedFox
Name: Hotel, dtype: object
```

[56]:
```
df.FoodPreference.replace(['Vegetarian','veg'],'Veg')
```

[56]:
```
0         Veg
1     Non-Veg
2         Veg
3         Veg
4         Veg
5     Non-Veg
6         Veg
7         Veg
8     Non-Veg
10    non-Veg
Name: FoodPreference, dtype: object
```

[57]:
```
 df.FoodPreference.replace(['non-Veg'],'Non-Veg')
```

[57]:
```
0            veg
1        Non-Veg
2            Veg
3            Veg
4     Vegetarian
5        Non-Veg
6     Vegetarian
7            Veg
8        Non-Veg
10       Non-Veg
Name: FoodPreference, dtype: object
```

[58]:
```
df.EstimatedSalary.fillna(round(df.EstimatedSalary.mean()))
```

[58]:
```
0      40000.0
1      59000.0
2      30000.0
3     120000.0
4      45000.0
5     122220.0
6      21122.0
7     345673.0
8      96755.0
10     87777.0
Name: EstimatedSalary, dtype: float64
```

[59]:
```
df.NoOfPax.fillna(round(df.NoOfPax.median()))
df['Rating(1-5)'].fillna(round(df['Rating(1-5)'].median()))
df.Bill.fillna(round(df.Bill.mean()))
df
```

[59]:
```
    CustomerID Age_Group  Rating(1-5)      Hotel FoodPreference    Bill  \
0          1.0     20-25          4.0       Ibis            veg  1300.0
1          2.0     30-35          5.0  LemonTree        Non-Veg  2000.0
2          3.0     25-30          6.0     RedFox            Veg  1322.0
3          4.0     20-25          NaN  LemonTree            Veg  1234.0
4          5.0       35+          3.0       Ibis     Vegetarian   989.0
5          6.0       35+          3.0       Ibys        Non-Veg  1909.0
6          7.0       35+          4.0     RedFox     Vegetarian  1000.0
7          8.0     20-25          7.0  LemonTree            Veg  2999.0
8          9.0     25-30          2.0       Ibis        Non-Veg  3456.0
10        10.0     30-35          5.0     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
10     4     87777.0
```

```
[ ]:
```

exp6

November 18, 2025

```
[1]: import numpy as np
```

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

```
[7]: import os

     os.chdir("D:\\pandas")
     df=pd.read_csv("pre_process_datasample.csv")
     df
```

```
[7]:    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
```

```
[5]: df.head()
```

```
[5]:    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
```

```
[6]: df.Country.fillna(df.Country.mode()[0])
```

```
[6]: 0       France
     1        Spain
     2      Germany
     3        Spain
```

```
4      Germany
5       France
6        Spain
7       France
8      Germany
9       France
Name: Country, dtype: object
```

```
[8]: features=df.iloc[:,:-1].values
```

```
[ ]: label=df.iloc[:,-1].values
```

```
[10]: from sklearn.impute import SimpleImputer

age=SimpleImputer(strategy="mean",missing_values=np.nan)

Salary=SimpleImputer(strategy="mean",missing_values=np.nan)
```

```
[11]: age.fit(features[:,[1]])
```

```
[11]: SimpleImputer()
```

```
[12]: Salary.fit(features[:,[2]])
```

```
[12]: SimpleImputer()
```

```
[13]: SimpleImputer()
```

```
[13]: SimpleImputer()
```

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

```
[14]: 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)
```

```
[15]: from sklearn.preprocessing import OneHotEncoder
oh = OneHotEncoder(sparse_output=False)
```

```
Country=oh.fit_transform(features[:,[0]])
Country
```

```
[15]:  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.]])
```

```
[16] : final_set=np.concatenate((Country,features[:,[1,2]]),axis=1)
       final_set
```

```
[16]:  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)
```

```
[17] : from sklearn.preprocessing import StandardScaler
       sc=StandardScaler()
       sc.fit(final_set)
       feat_standard_scaler=sc.transform(final_set)
       feat_standard_scaler
```

```
[17] : 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]])
```

[18] :

```
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
```

[18]:

```
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]])
```

[ ]:

exp7

November 18, 2025

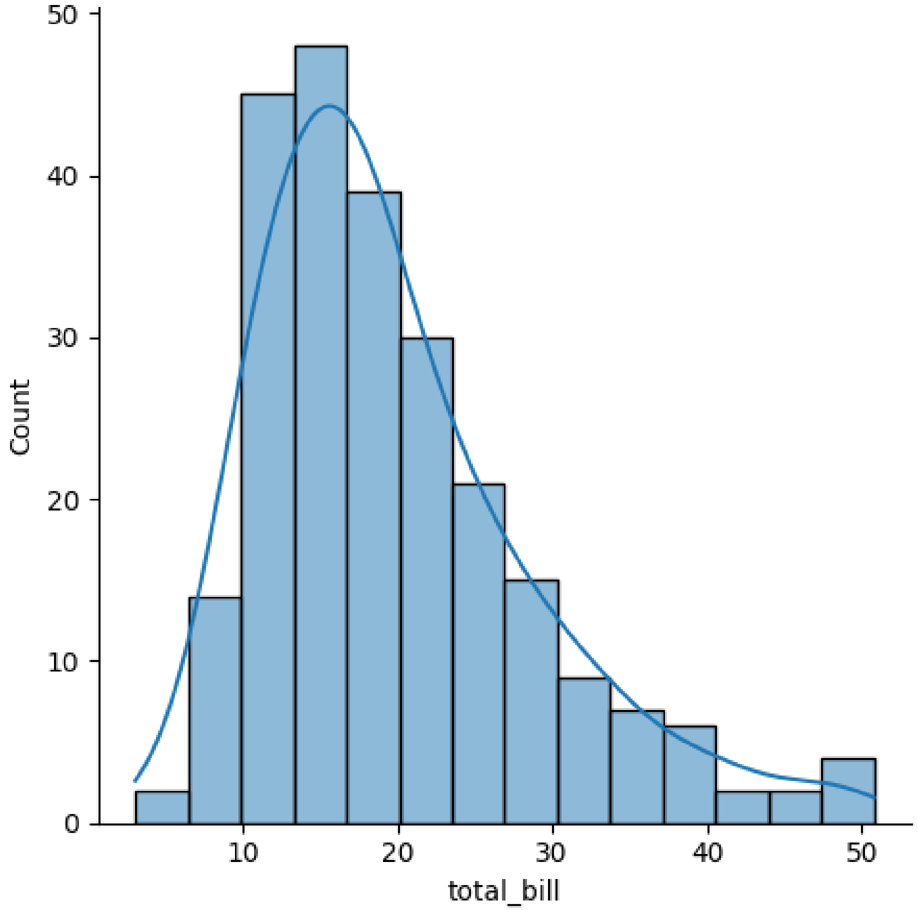
```
[1]: import seaborn as sns
     import pandas as pd
     import numpy as np
     import matplotlib.pyplot as plt
     %matplotlib inline
     tips=sns.load_dataset('tips')
```

```
[2]: tips.head()
```

```
[2]:    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
```

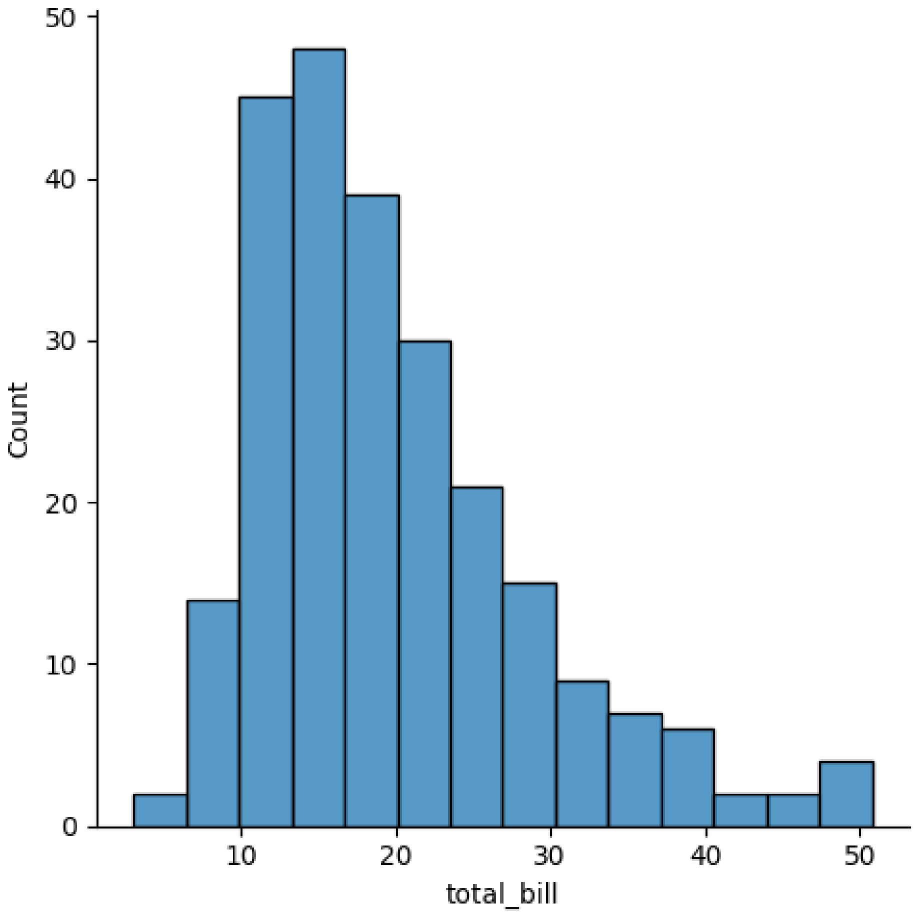
```
[3]: sns.displot(tips.total_bill,kde=True)
```

```
[3]: <seaborn.axisgrid.FacetGrid at 0x201fdd6a660>
```



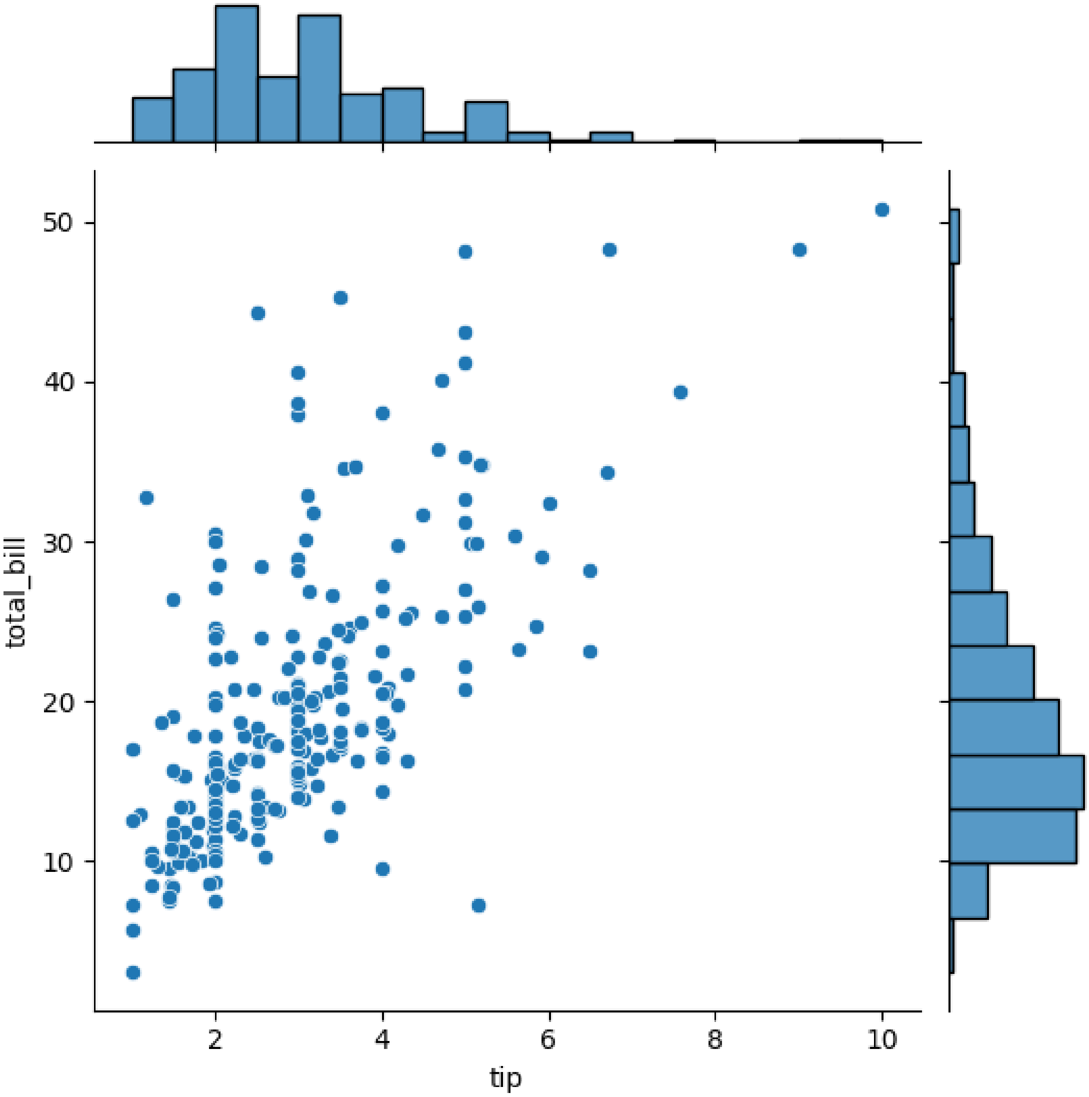
```
[4] : sns.displot(tips.total_bill,kde=False)
```

```
[4] : <seaborn.axisgrid.FacetGrid at 0x201fdf4b250>
```



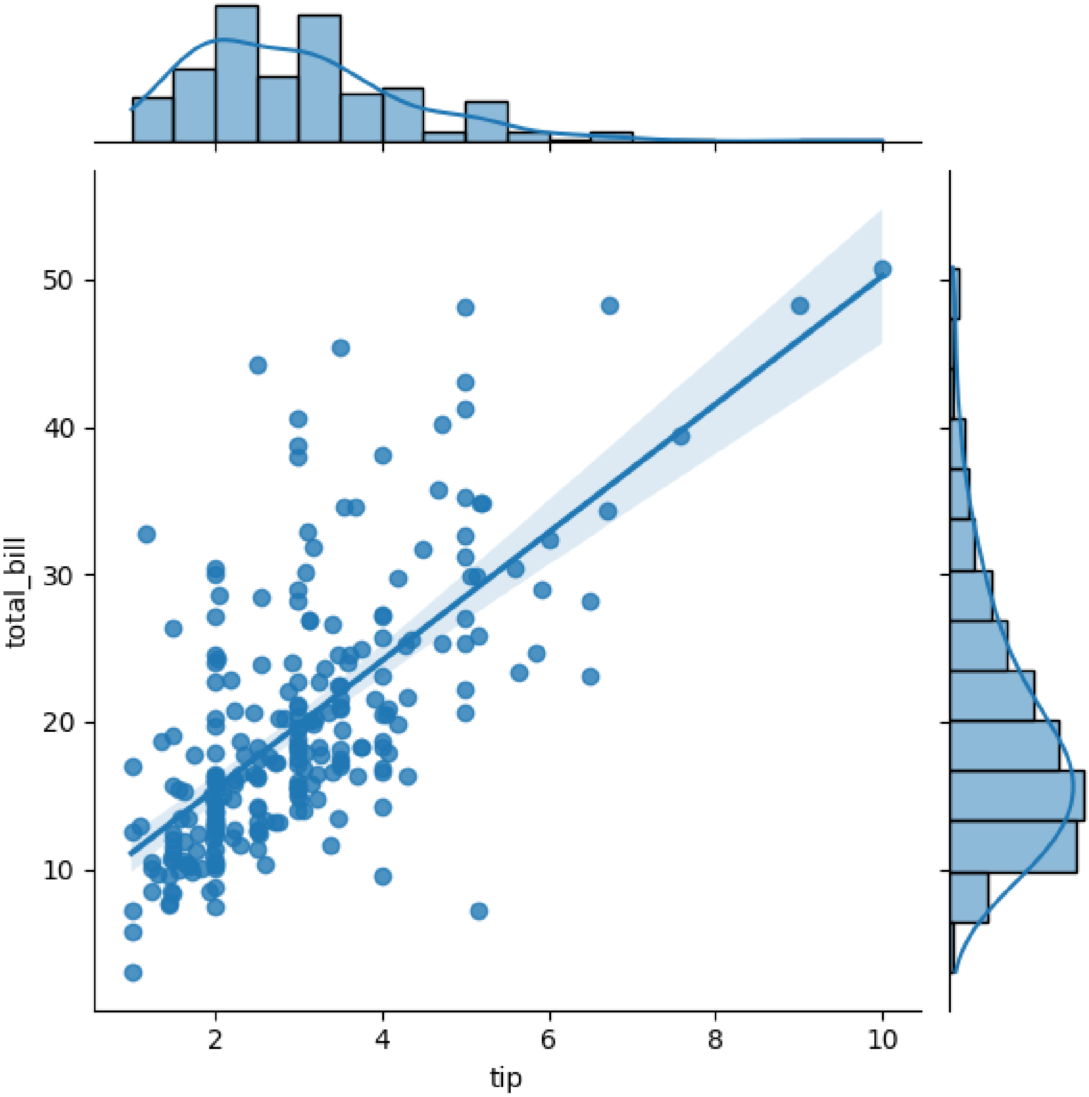
```
[5]: sns.jointplot(x=tips.tip,y=tips.total_bill)
```

```
[5]: <seaborn.axisgrid.JointGrid at 0x201fdde9fd0>
```



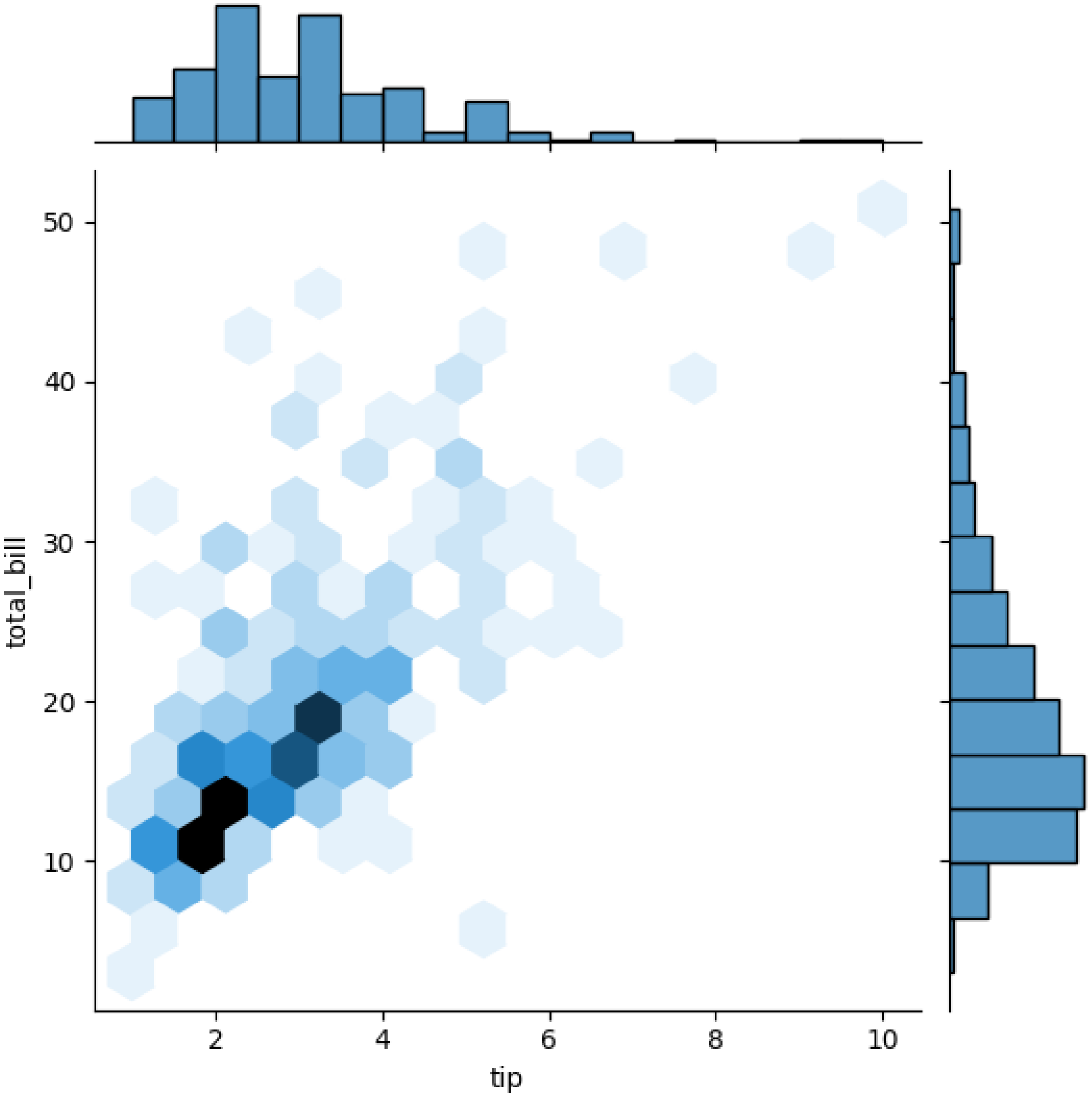
```
[6] : sns.jointplot(x=tips.tip,y=tips.total_bill,kind="reg")
```

```
[6] : <seaborn.axisgrid.JointGrid at 0x201ff15c550>
```



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

```
[7]: <seaborn.axisgrid.JointGrid at 0x201ff56da90>
```

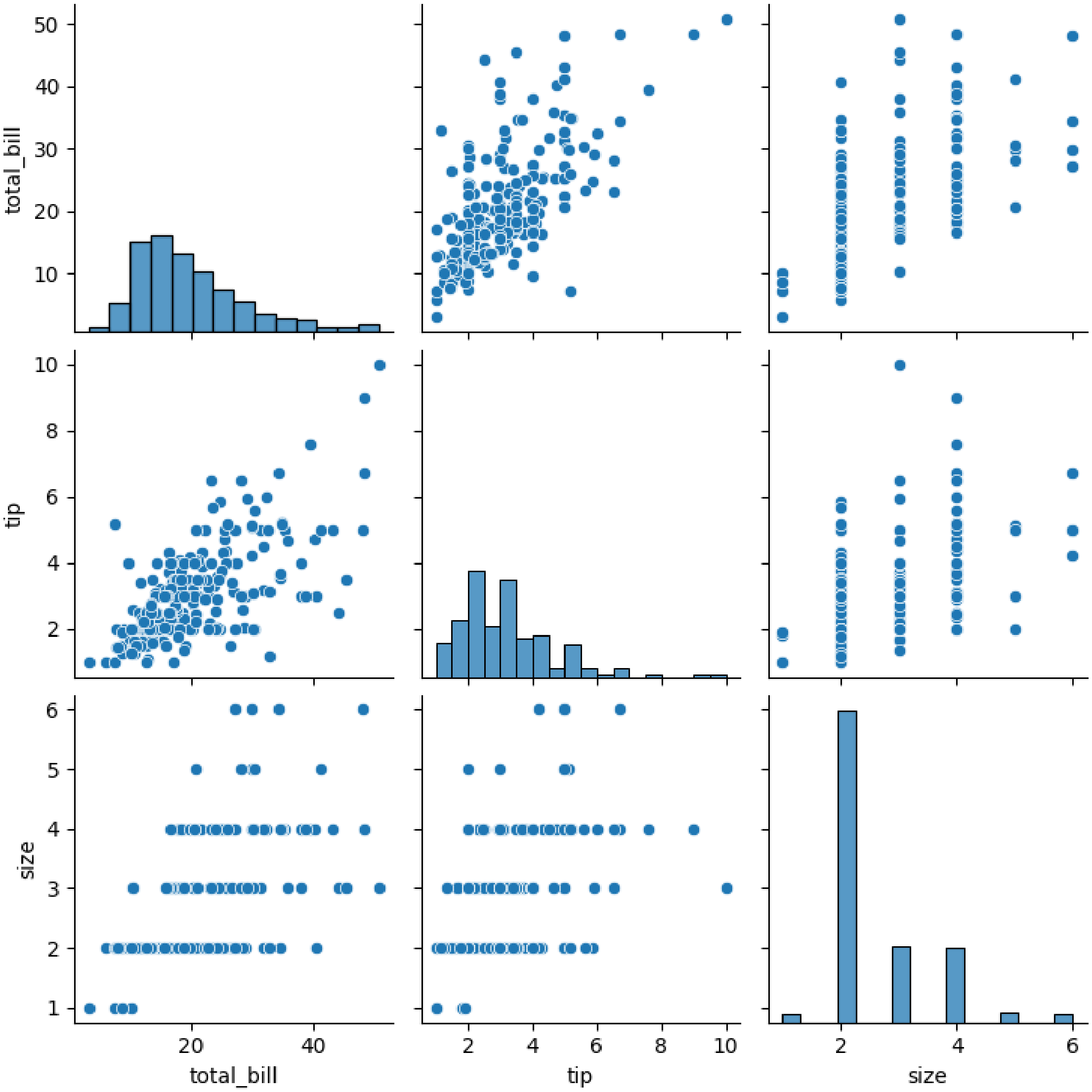


[8] :

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

[8] :

```
<seaborn.axisgrid.PairGrid at 0x201fddeaf90>
```

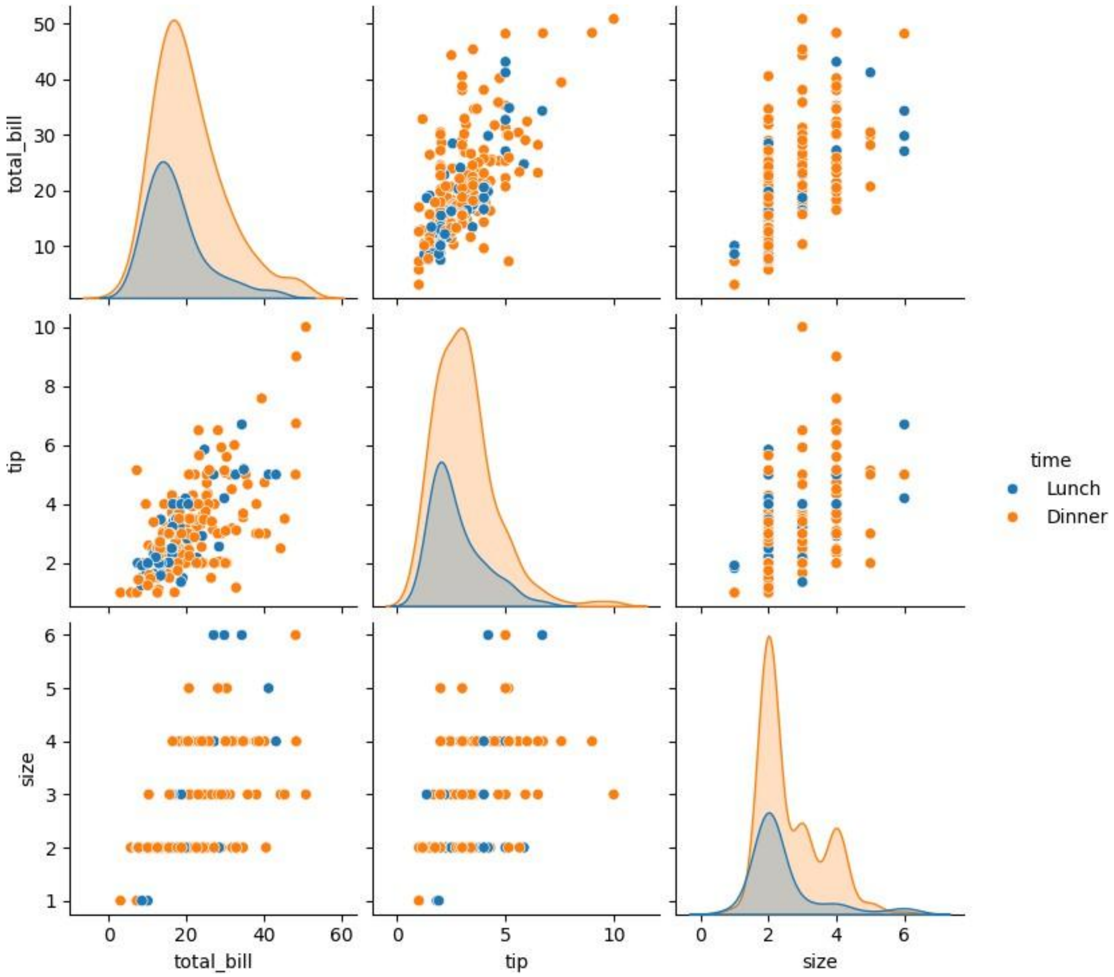


[9] :
```
tips.time.value_counts()
```

[9]:
```
time
Dinner    176
Lunch      68
Name: count, dtype: int64
```

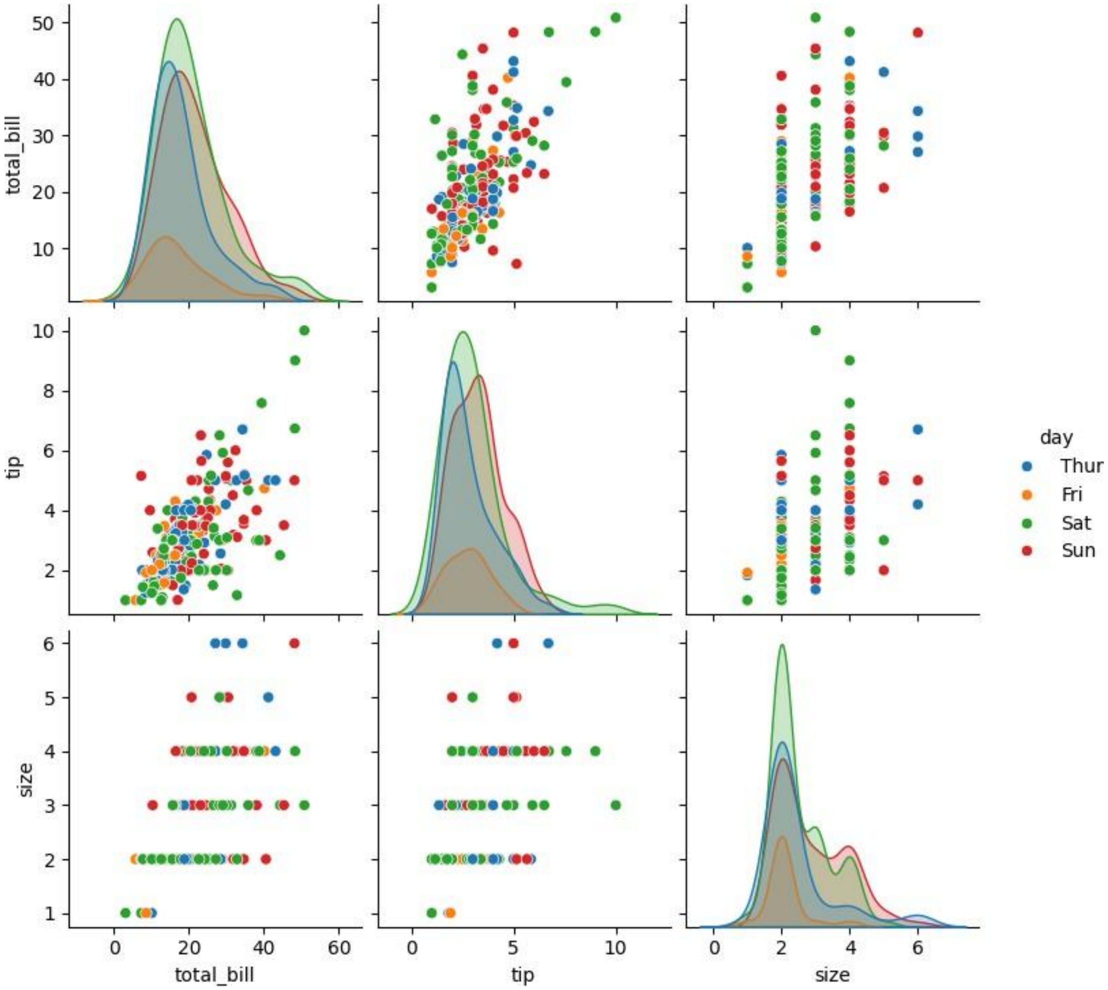
[10]:
```
sns.pairplot(tips,hue='time')
```

[10]:
```
<seaborn.axisgrid.PairGrid at 0x201843e9310>
```



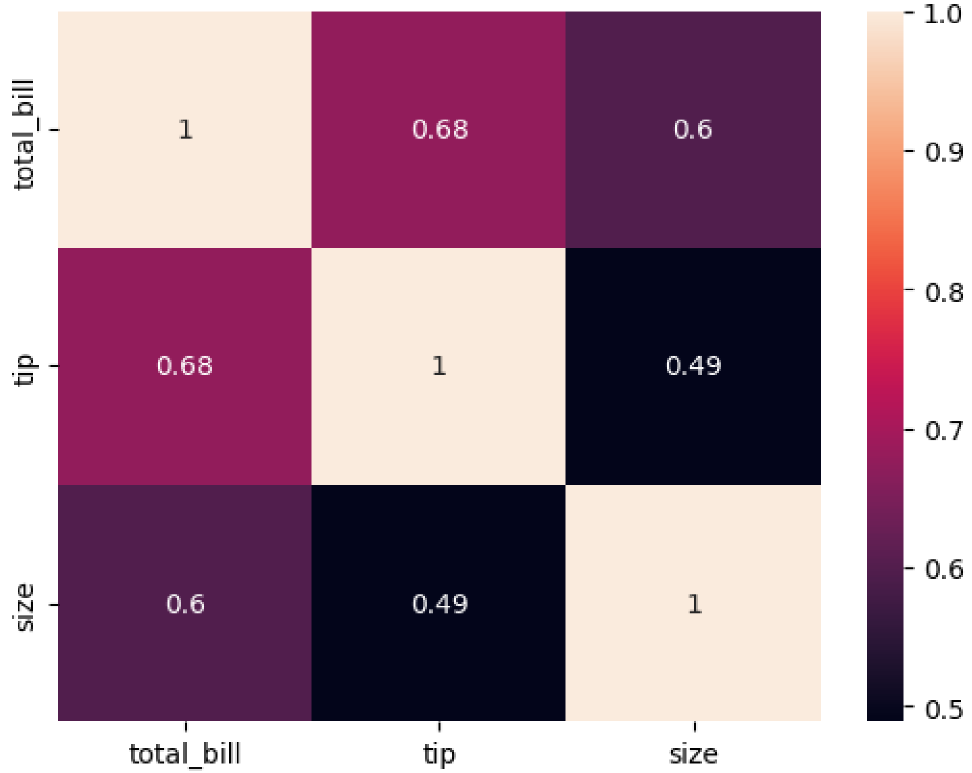
```
[11]: sns.pairplot(tips,hue='day')
```

```
[11]: <seaborn.axisgrid.PairGrid at 0x20184cbd950>
```



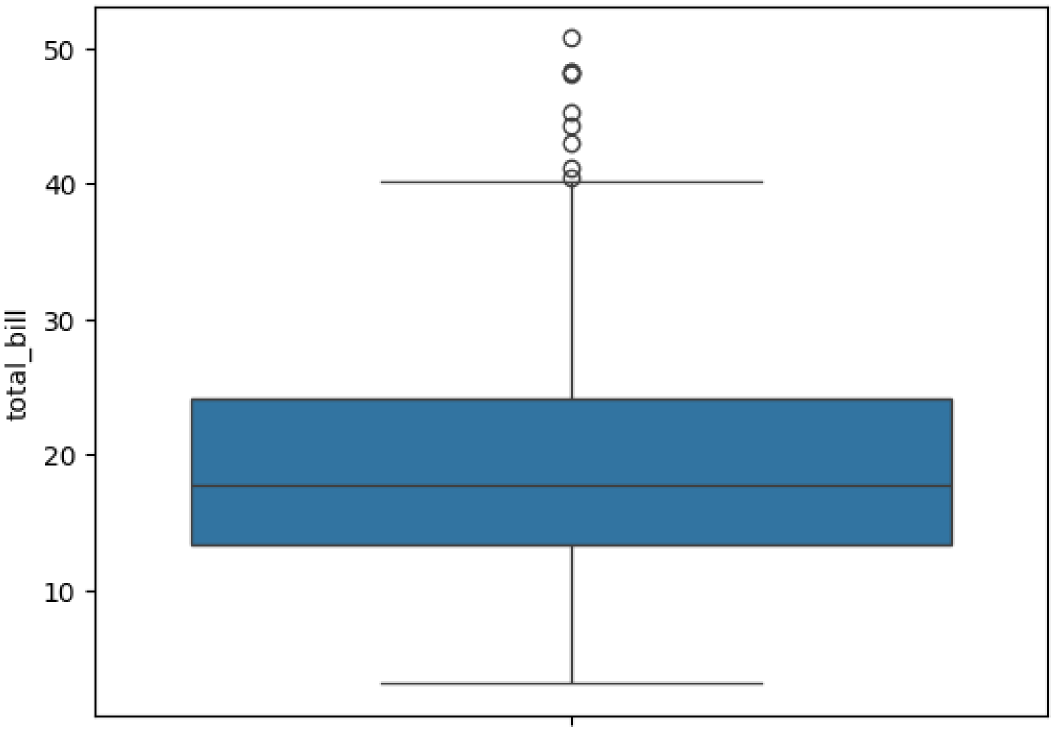
[12]:
```
sns.heatmap(tips.corr(numeric_only=True),annot=True)
```

[12]:
```
<Axes: >
```



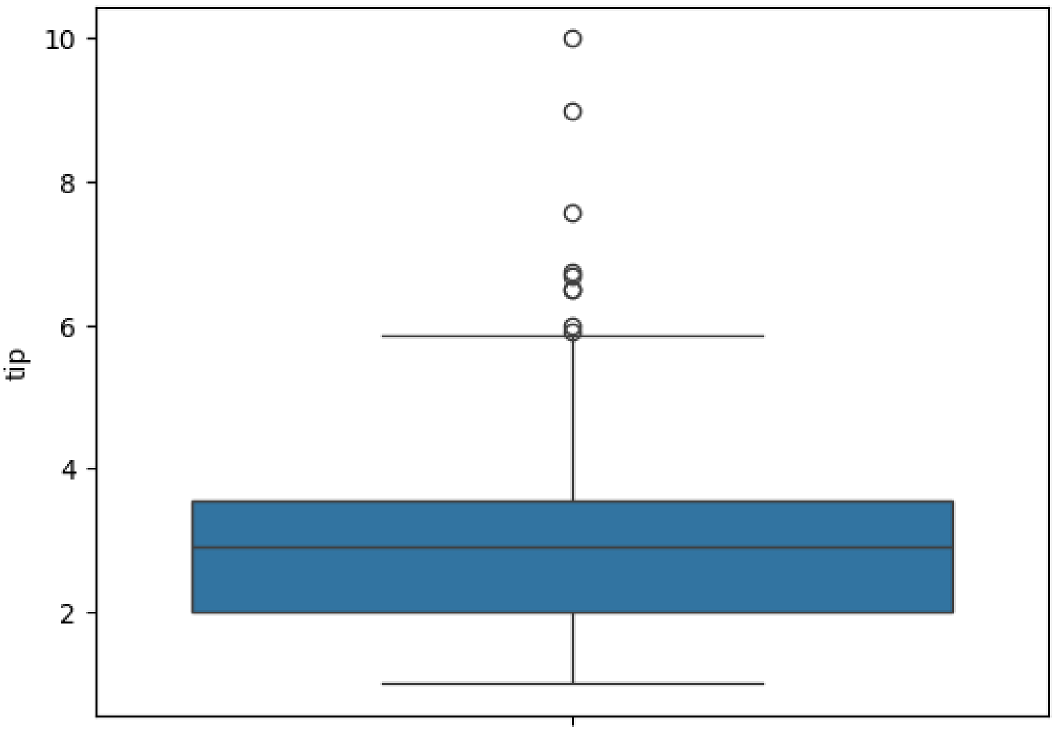
[13]:
```
sns.boxplot(tips.total_bill)
```

[13]:
```
<Axes:  ylabel='total_bill'>
```



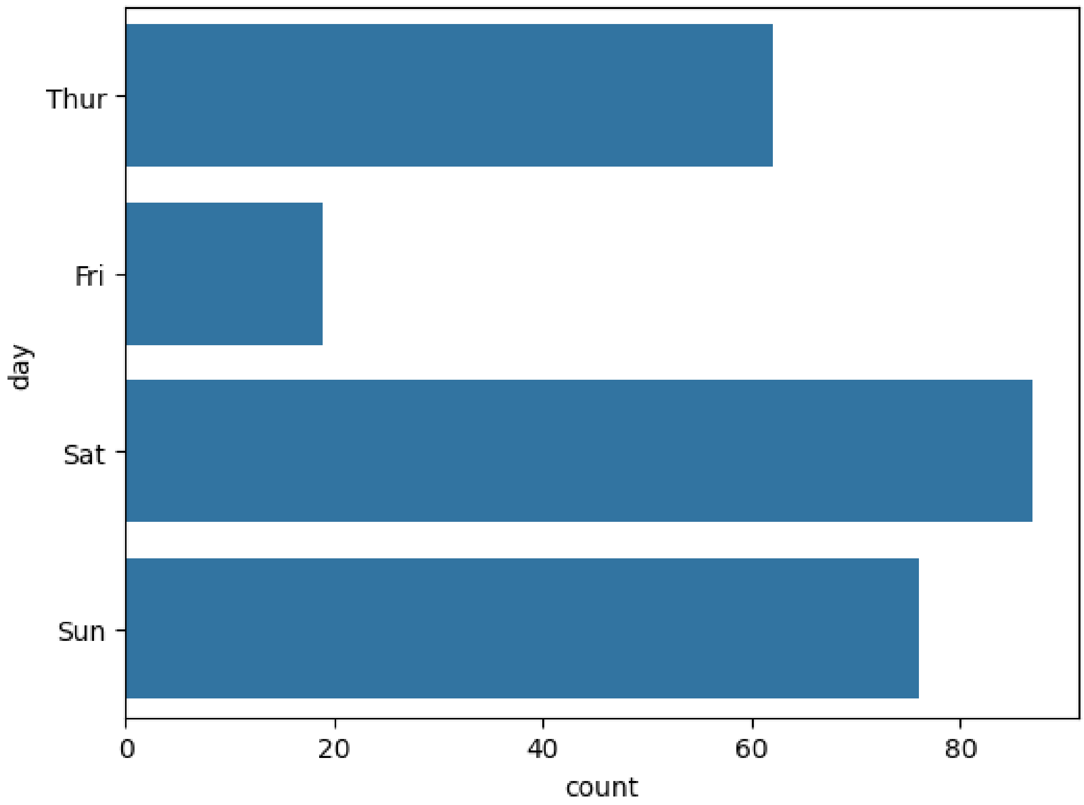
```
[14]: sns.boxplot(tips.tip)
```

```
[14]: <Axes: ylabel='tip'>
```



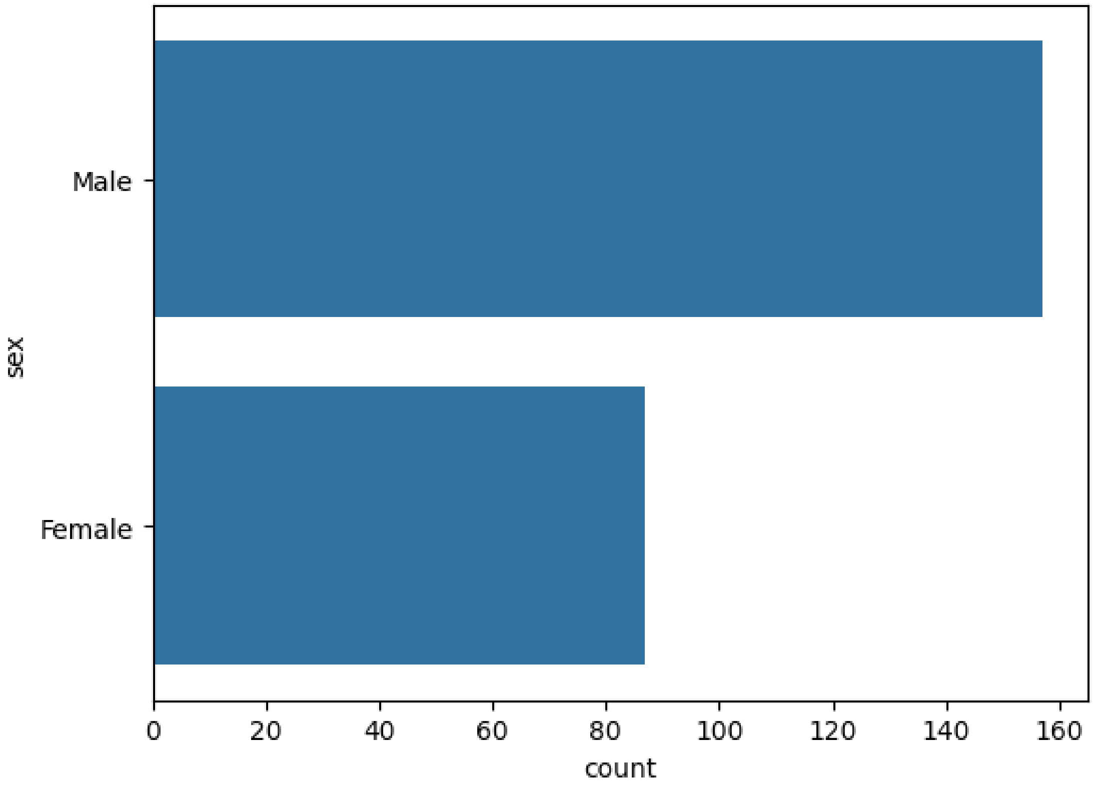
```
[15]: sns.countplot(tips.day)
```

```
[15]: <Axes: xlabel='count', ylabel='day'>
```



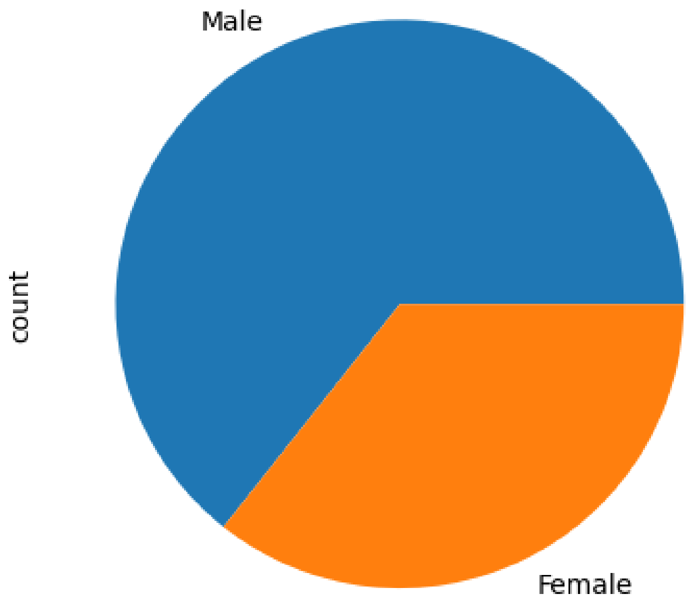
[16]:
```
sns.countplot(tips.sex)
```

[16]:
```
<Axes: xlabel='count', ylabel='sex'>
```

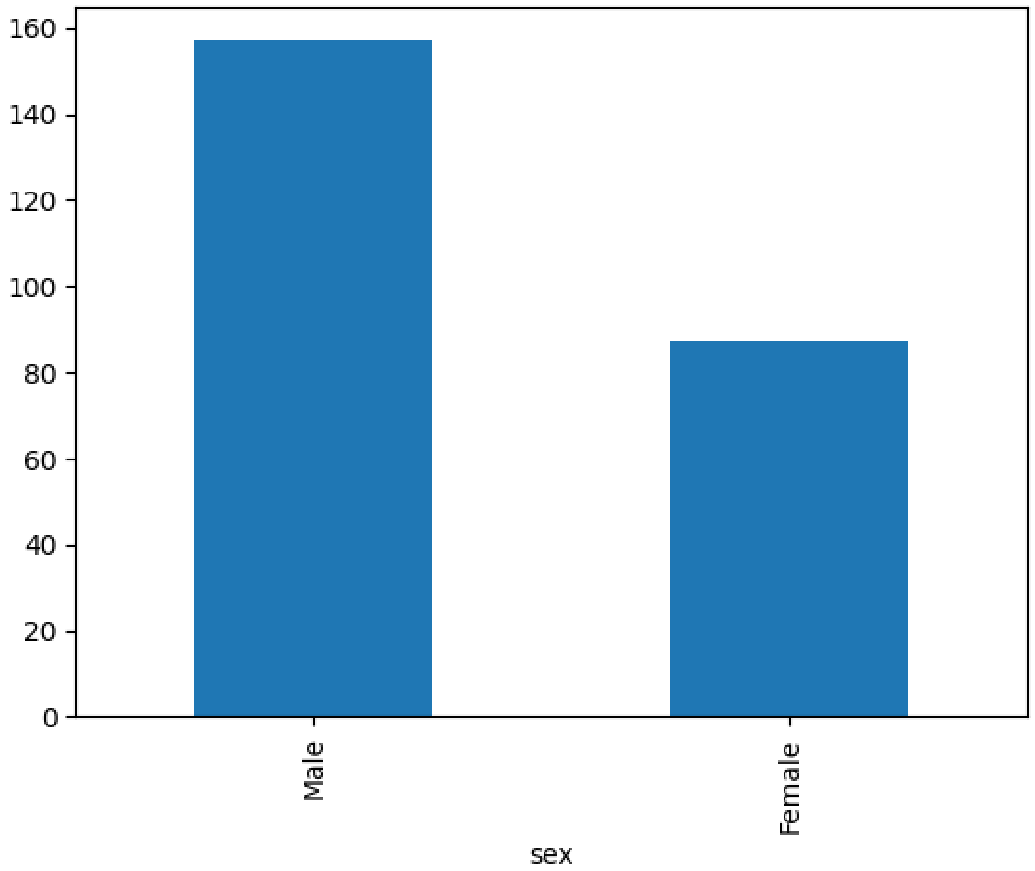


[17]:
```
tips.sex.value_counts().plot(kind='pie')
```

[17]:
```
<Axes: ylabel='count'>
```

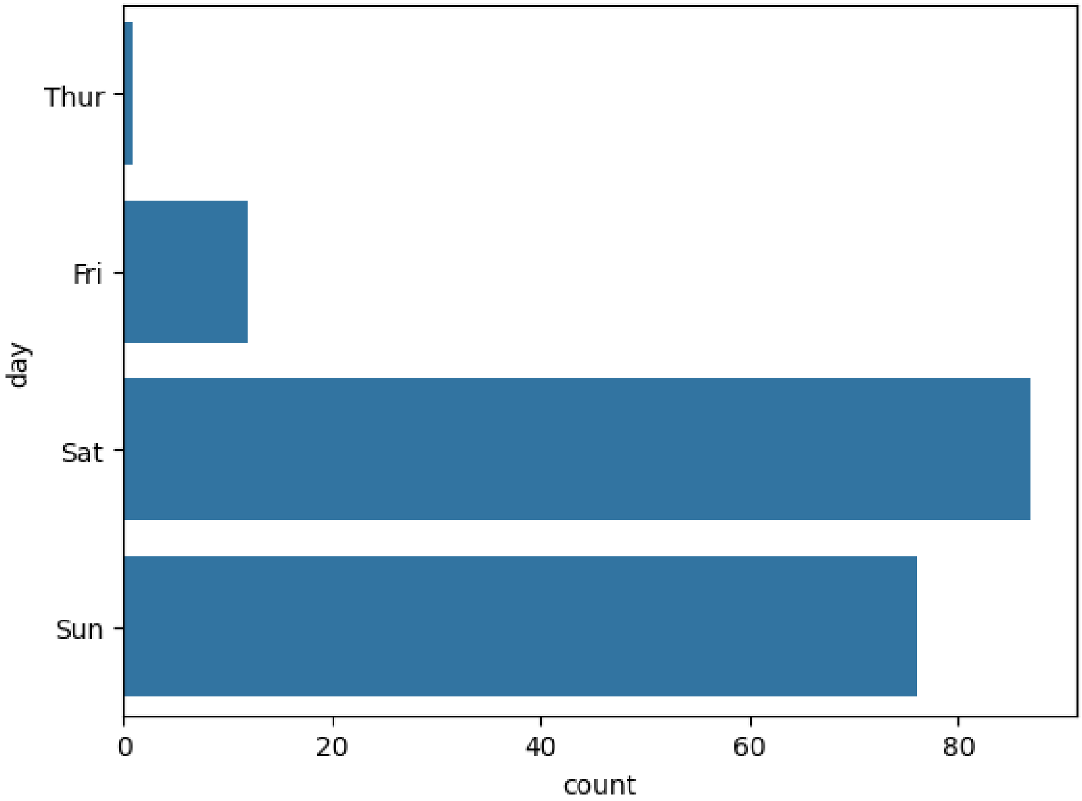


```
[18]: tips.sex.value_counts().plot(kind='bar')

[18]: <Axes: xlabel='sex'>
```



```
[19]: sns.countplot(tips[tips.time=='Dinner']['day'])
```

```
[19]: <Axes: xlabel='count', ylabel='day'>
```


Thur
Fri
Sat
Sun
day
0
20
40
60
80
count

```
[ ]:
```

In [ ]:
```
import numpy as np
import pandas as pd
df=pd.read_csv('Salary_data.csv')
df
```

In [19]:
```
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: 612.0 bytes
```

In [3]:
```
df.dropna(inplace=True)
```

In [4]:
```
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: 612.0 bytes
```

In [5]:
```
df.describe()
```

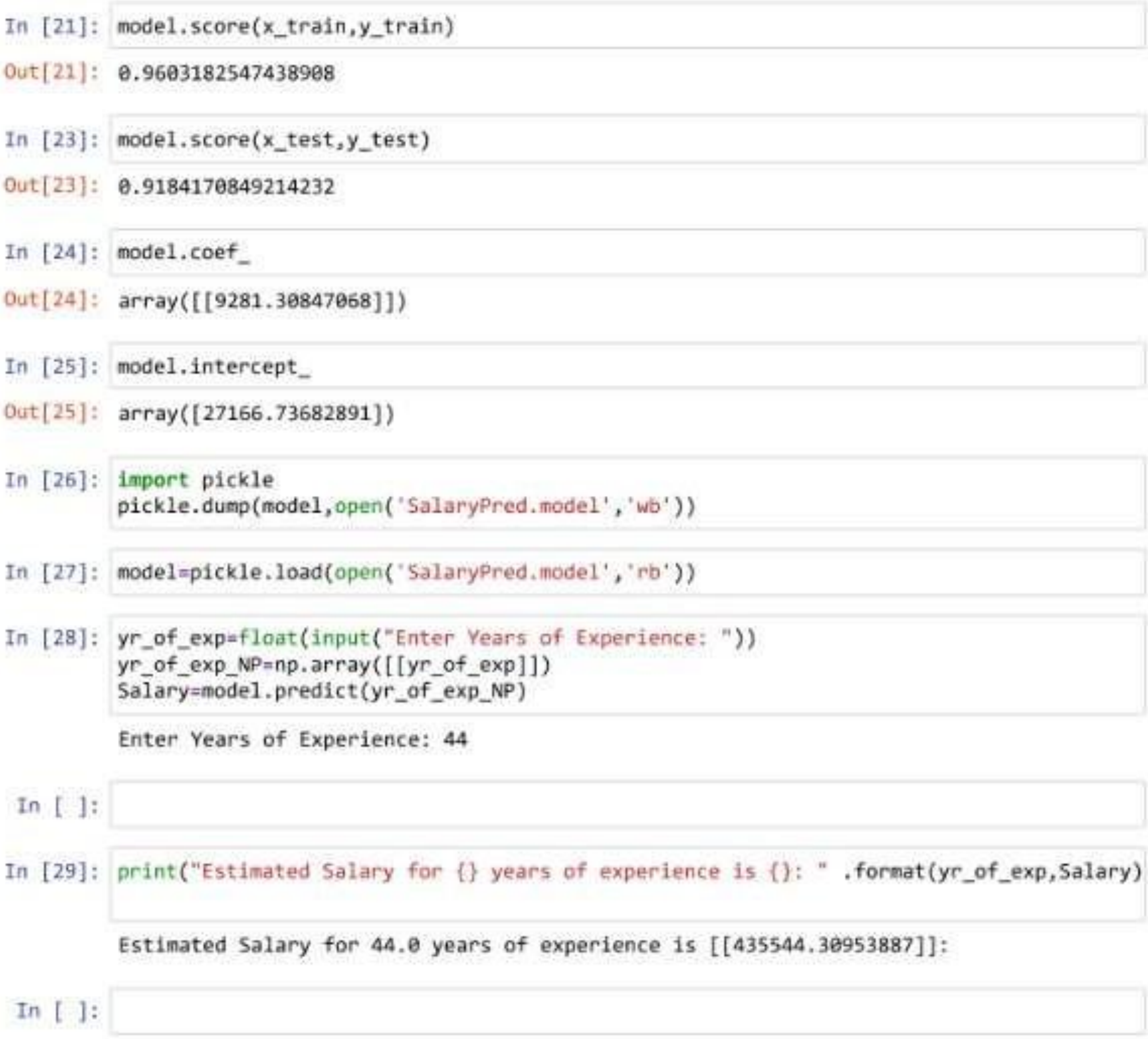
Out[5]:

	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

In [6]:
```
features=df.iloc[:,[0]].values
label=df.iloc[:,[1]].values
```

In [7]:
```
from sklearn.model_selection import train_test_split
x_train,x_test,y_train,y_test=train_test_split(features,label,test_size=0.2,random_st
```

In [20]:
```
from sklearn.linear_model import LinearRegression
model=LinearRegression()
model.fit(x_train,y_train)
```



```
In [21]: model.score(x_train,y_train)

Out[21]: 0.9603182547438908

In [23]: model.score(x_test,y_test)

Out[23]: 0.9184170849214232

In [24]: model.coef_

Out[24]: array([[9281.30847068]])

In [25]: model.intercept_

Out[25]: array([27166.73682891])

In [26]: import pickle
         pickle.dump(model,open('SalaryPred.model','wb'))

In [27]: model=pickle.load(open('SalaryPred.model','rb'))

In [28]: 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

In [ ]:

In [29]: print("Estimated Salary for {} years of experience is {}: " .format(yr_of_exp,Salary)

         Estimated Salary for 44.0 years of experience is [[435544.30953887]]:

In [ ]:
```

In [1]:
```
import numpy as np
import pandas as pd
df=pd.read_csv('Social_Network_Ads.csv')
df
```

Out[1]:

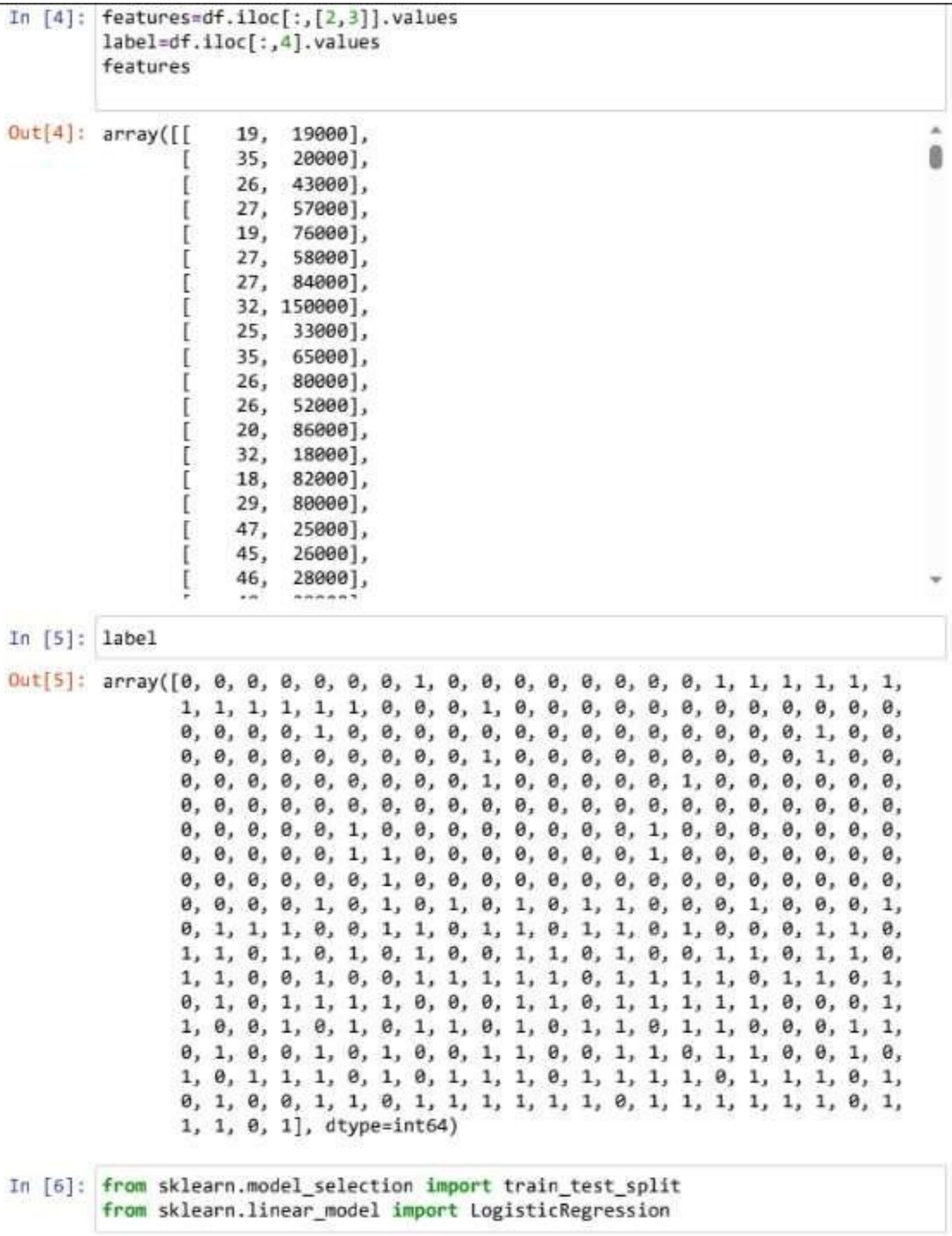
	User ID	Gender	Age	EstimatedSalary	Purchased
0	15624510	Male	19	19000	0
1	15810944	Male	35	20000	0
2	15668575	Female	26	43000	0
3	15603246	Female	27	57000	0
4	15804002	Male	19	76000	0
...	...	...	...	...	...
395	15691863	Female	46	41000	1
396	15706071	Male	51	23000	1
397	15654296	Female	50	20000	1
398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

400 rows × 5 columns

In [2]:
```
df.head()
```

Out[2]:

	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



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

```
Out[4]: 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],
```

```
In [5]: label
```

```
Out[5]: array([0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 1, 1, 1, 1, 1, 1,
               1, 1, 1, 1, 1, 1, 0, 0, 0, 1, 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, 0, 0, 0, 0, 0, 0, 1, 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, 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, 1, 0, 1, 0, 1, 0, 1, 0, 1, 1, 0, 0, 0, 1, 0, 0, 0, 1,
               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, 1, 0, 1, 0, 1, 0, 0, 1, 1, 0, 1, 0, 0, 1, 1, 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, 1,
               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,
               1, 1, 0, 1], dtype=int64)
```

```
In [6]: from sklearn.model_selection import train_test_split
        from sklearn.linear_model import LogisticRegression
```

In [7]:
```
for i in range(1,401):
  x_train,x_test,y_train,y_test=train_test_split(features,label,test_size=0.
  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 0.6875 Train0.63125 Random State 3
Test 0.7375 Train0.61875 Random State 4
Test 0.6625 Train0.6375 Random State 5
Test 0.65 Train0.640625 Random State 6
Test 0.675 Train0.634375 Random State 7
Test 0.675 Train0.634375 Random State 8
Test 0.65 Train0.640625 Random State 10
Test 0.6625 Train0.6375 Random State 11
Test 0.7125 Train0.625 Random State 13
Test 0.675 Train0.634375 Random State 16
Test 0.7 Train0.628125 Random State 17
Test 0.7 Train0.628125 Random State 21
Test 0.65 Train0.640625 Random State 24
Test 0.6625 Train0.6375 Random State 25
Test 0.75 Train0.615625 Random State 26
Test 0.675 Train0.634375 Random State 27
Test 0.7 Train0.628125 Random State 28
Test 0.6875 Train0.63125 Random State 29
Test 0.6875 Train0.63125 Random State 31
```

In [8]:
```
x_train,x_test,y_train,y_test=train_test_split(features,label,test_size=0.2,
finalModel=LogisticRegression()
finalModel.fit(x_train,y_train)
```

Out[8]:
```
LogisticRegression()
```

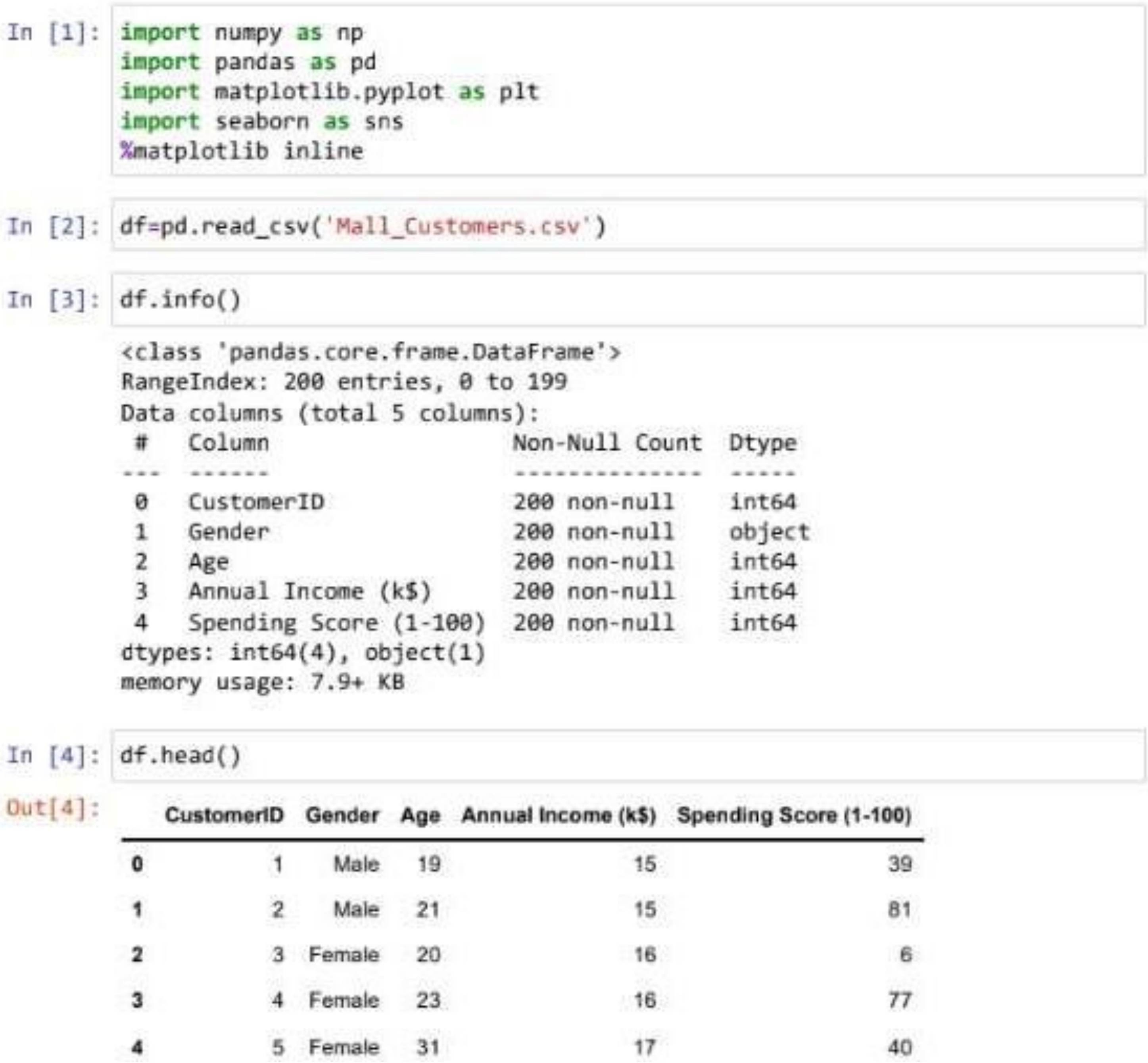
In a Jupyter environment, please rerun this cell to show the HTML representation or trust the notebook.
On GitHub, the HTML representation is unable to render, please try loading this page with nbviewer.org.

In [9]:
```
print(finalModel.score(x_train,y_train))
print(finalModel.score(x_test,y_test))
```

```
0.834375
0.9125
```

In [10]:
```
from sklearn.metrics import classification_report
print(classification_report(label,finalModel.predict(features)))
```

```
              precision    recall  f1-score   support

           0       0.85      0.93      0.89       257
           1       0.84      0.71      0.77       143
```



In [1]:

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

In [2]:

```
df=pd.read_csv('Mall_Customers.csv')
```

In [3]:

```
df.info()
```

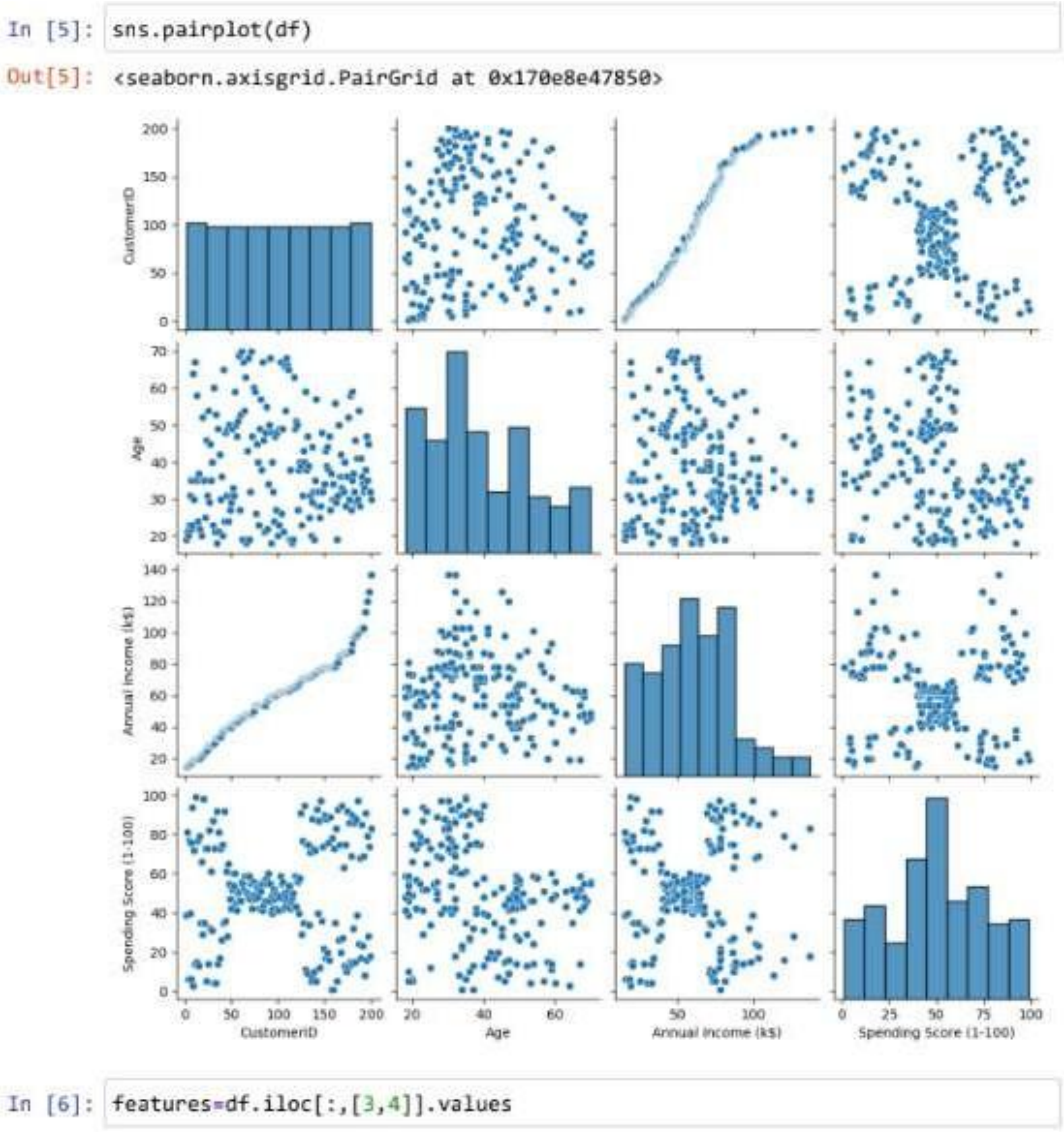
```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 200 entries, 0 to 199
Data columns (total 5 columns):
 #   Column                  Non-Null Count  Dtype 
---  ------                  --------------  ----- 
 0   CustomerID              200 non-null    int64 
 1   Gender                  200 non-null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

In [4]:

```
df.head()
```

Out[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



```
In [5]: sns.pairplot(df)
```

```
Out[5]: <seaborn.axisgrid.PairGrid at 0x170e8e47850>
```

```
In [6]: features=df.iloc[:,[3,4]].values
```

In [7]:
```
from sklearn.cluster import KMeans
model=KMeans(n_clusters=5)
model.fit(features)
KMeans(n_clusters=5)
```

```
C:\Users\Ayyadurai\AppData\Local\anaconda3\Lib\site-packages\sklearn\clust
er\_kmeans.py:870: FutureWarning: The default value of `n_init` will chang
e from 10 to 'auto' in 1.4. Set the value of `n_init` explicitly to suppre
ss the warning
  warnings.warn(
C:\Users\Ayyadurai\AppData\Local\anaconda3\Lib\site-packages\sklearn\clust
er\_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 c
an avoid it by setting the environment variable OMP_NUM_THREADS=1.
  warnings.warn(
```

Out[7]:
```
KMeans(n_clusters=5)
```

In a Jupyter environment, please rerun this cell to show the HTML representation or trust the notebook.

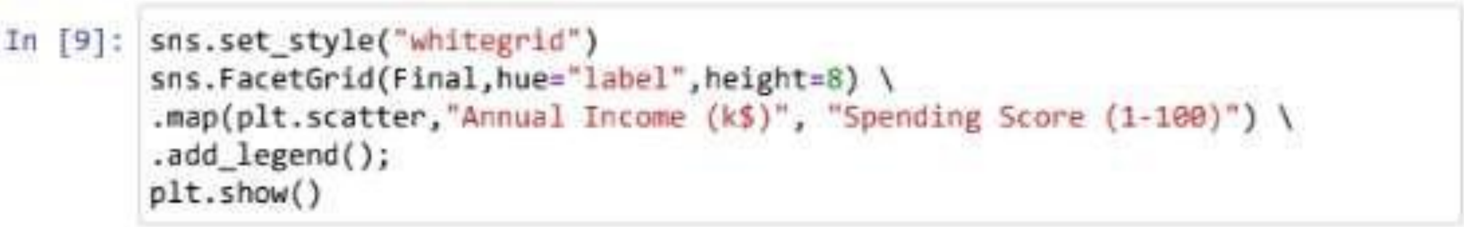
On GitHub, the HTML representation is unable to render, please try loading this page with nbviewer.org.

In [8]:
```
Final=df.iloc[:,[3,4]]
Final['label']=model.predict(features)
Final.head()
```

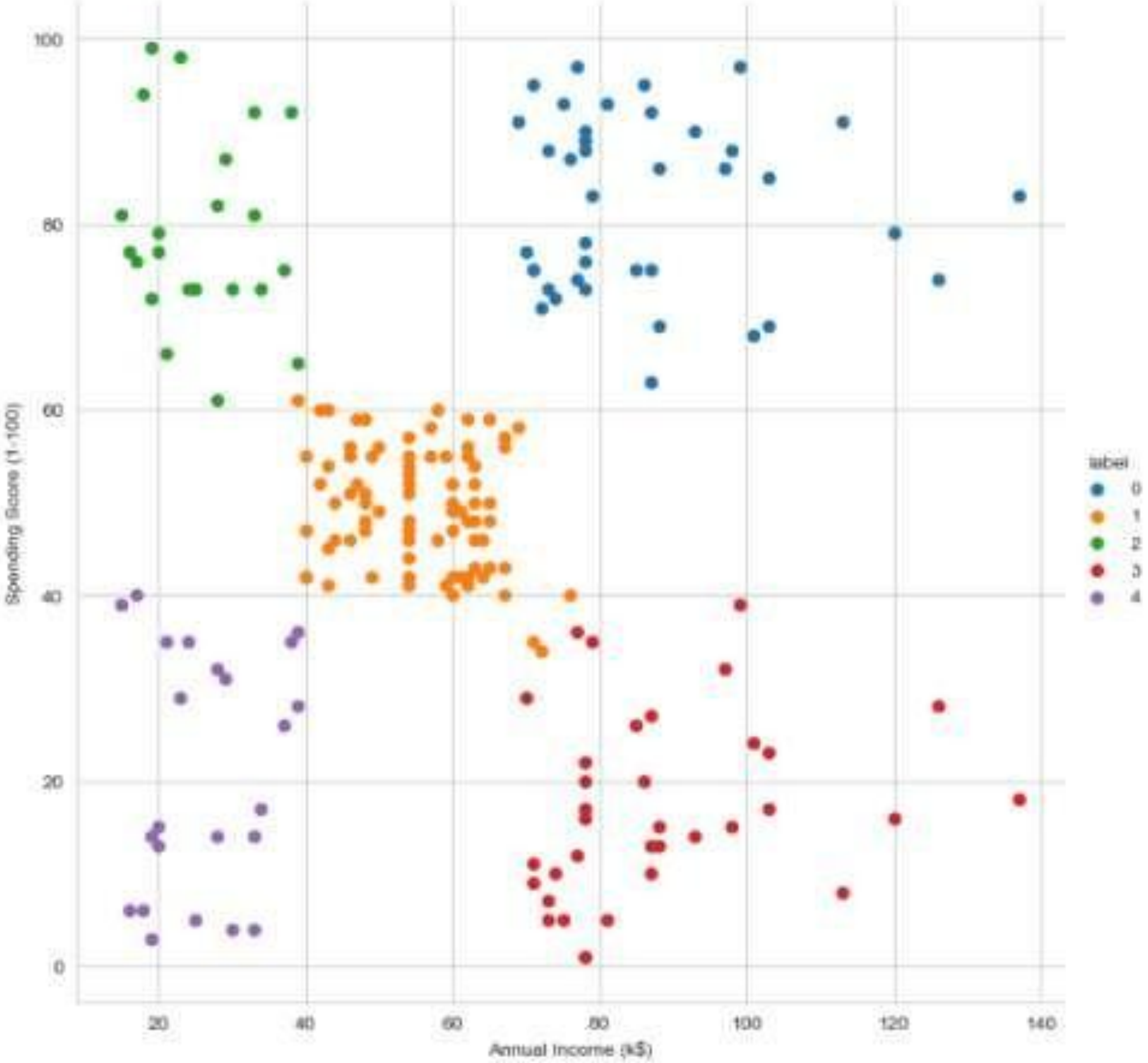
```
C:\Users\Ayyadurai\AppData\Local\Temp\ipykernel_8116\470183701.py:2: Setti
ngWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-doc
s/stable/user_guide/indexing.html#returning-a-view-versus-a-copy (https://
pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-
view-versus-a-copy)
  Final['label']=model.predict(features)
```

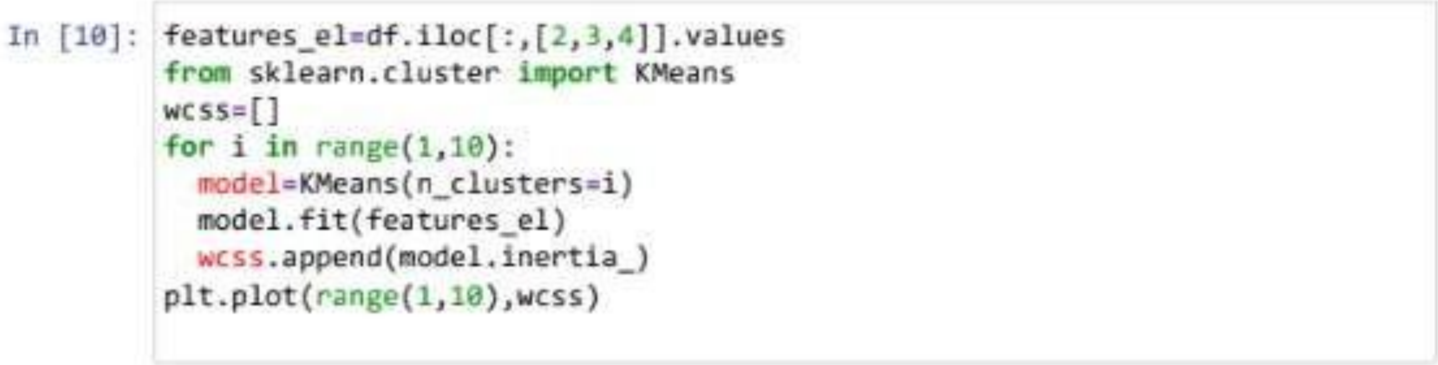
Out[8]:

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



```
In [9]: 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()
```





```
In [10]: 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)
```