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 : SARVESH R

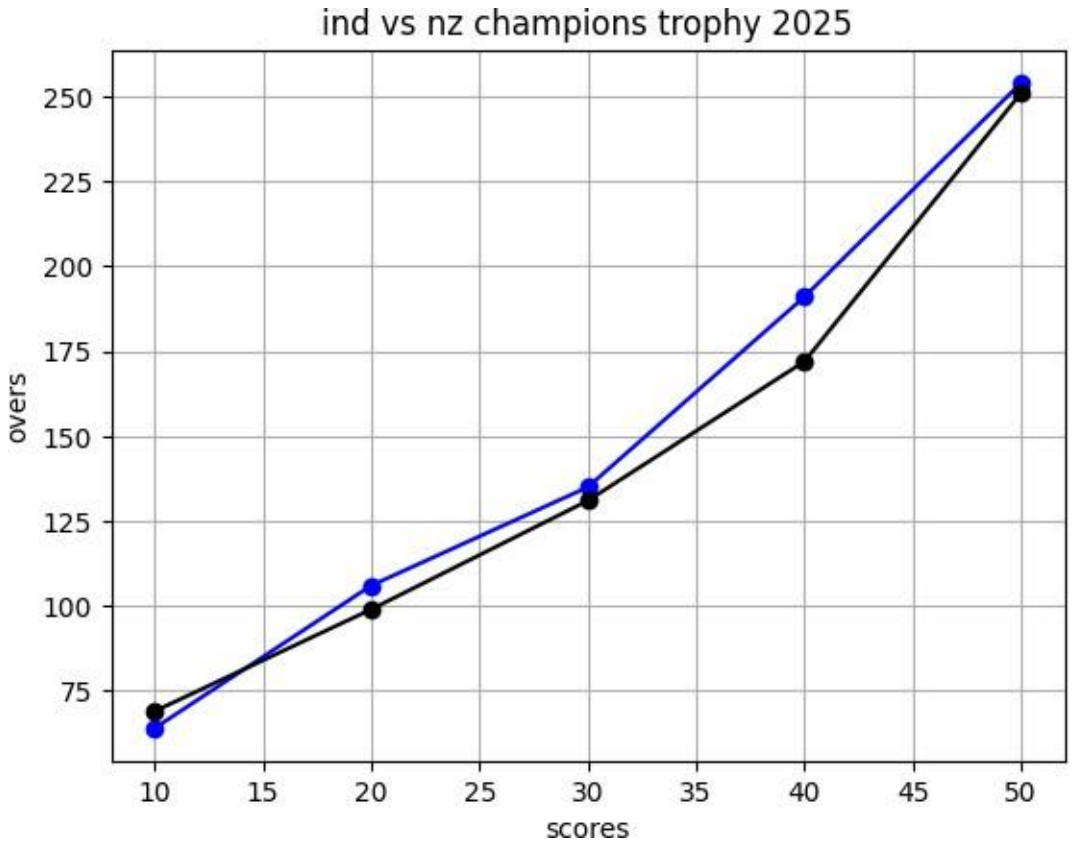
Register Number : 240701478

202
5

nnjusjhrr

November 18,

[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()
```



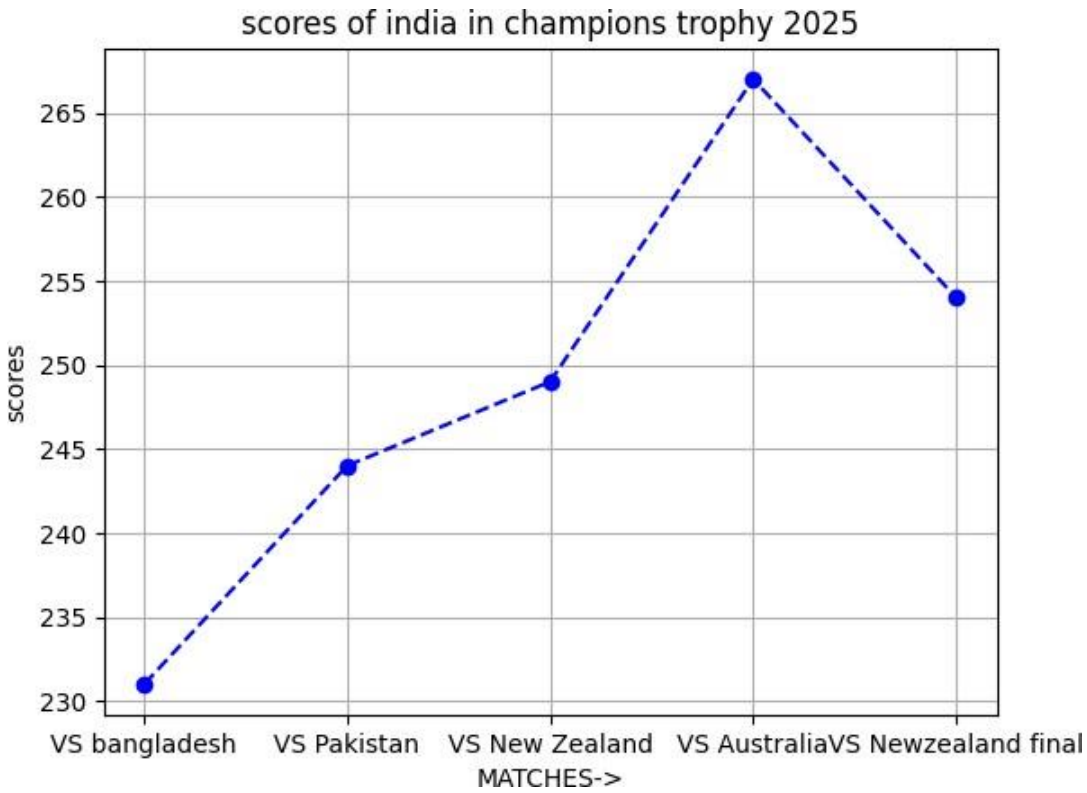
202
5

[ ]:

ipaczigq7

November 18,

[15]:
```
from matplotlib import pyplot as plt matches=['VS bangladesh','VS Pakistan','VS
New Zealand','VS Australia','VS
 sNewzealand 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()
```



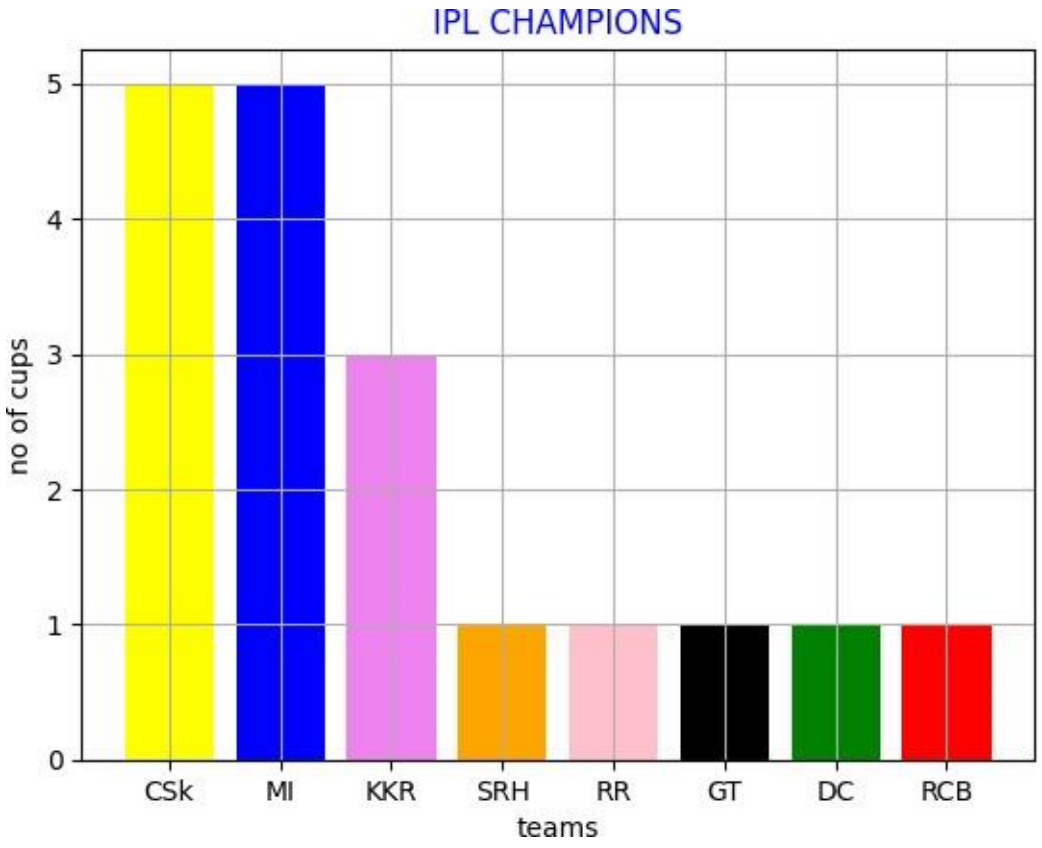
202
5

[ ]:

exp1c

18,

[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()
```



November 2025

[ ]:

exp1d

18,

[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()
```

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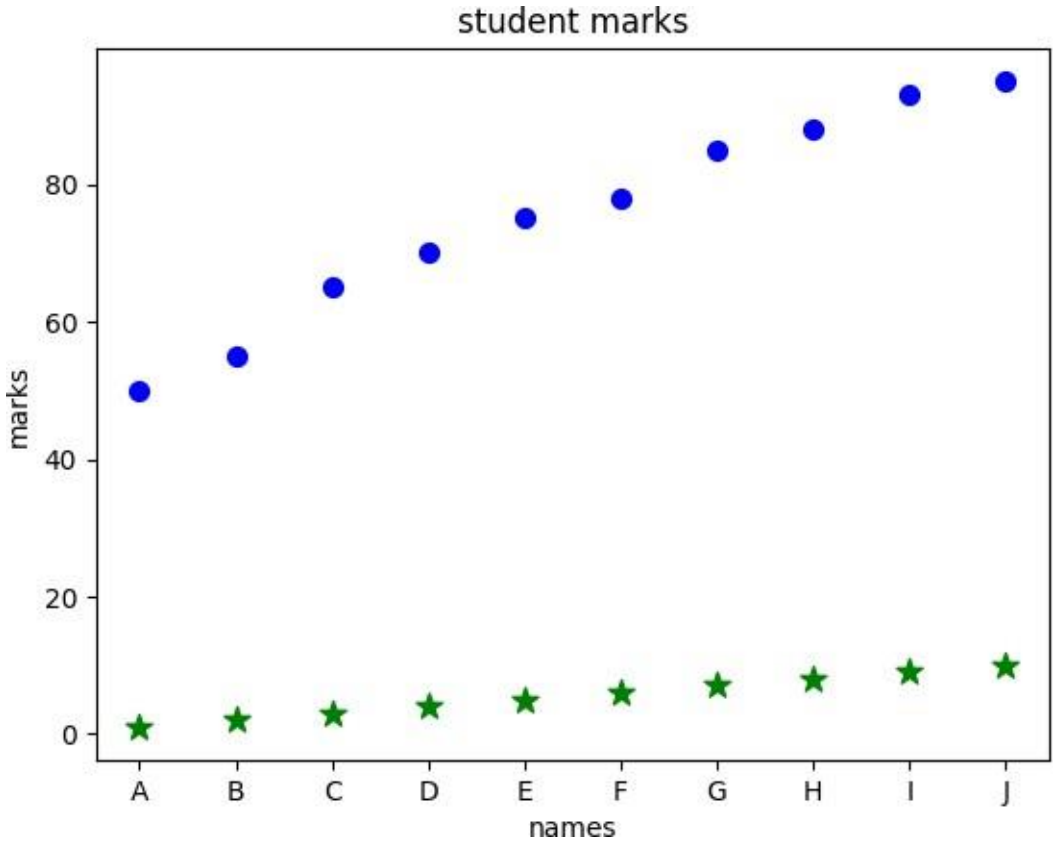


[ ]:

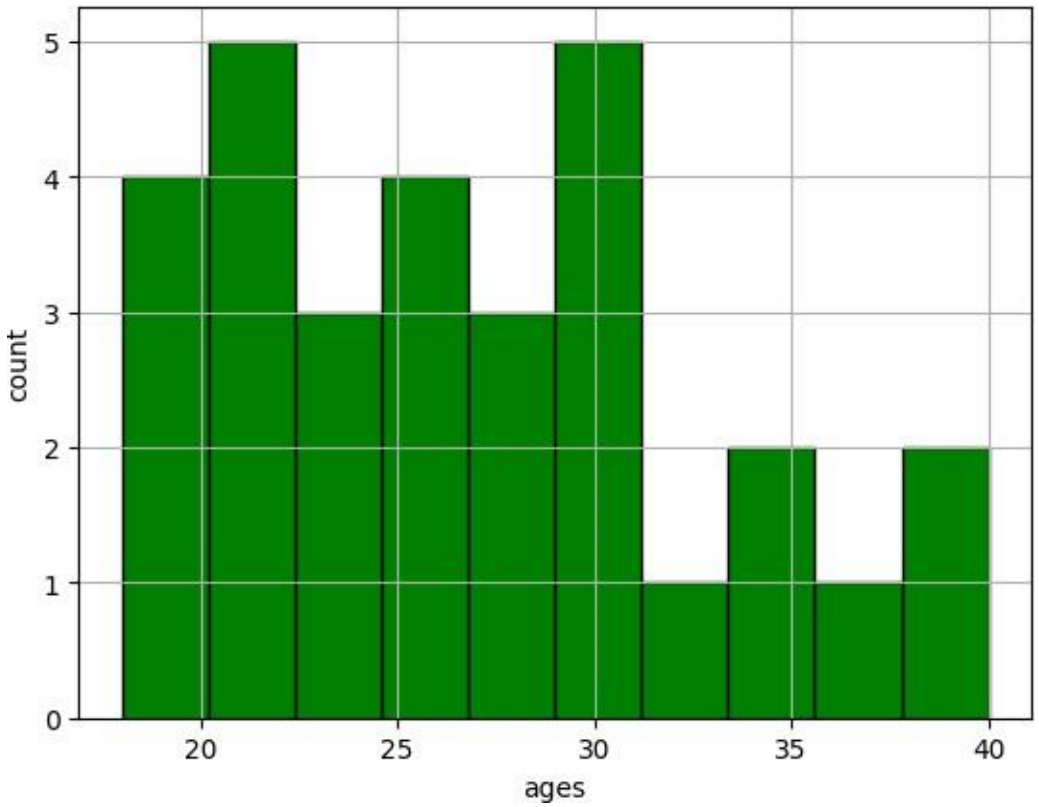
exp1e

18,

[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()
```



[ ]:

November 2025

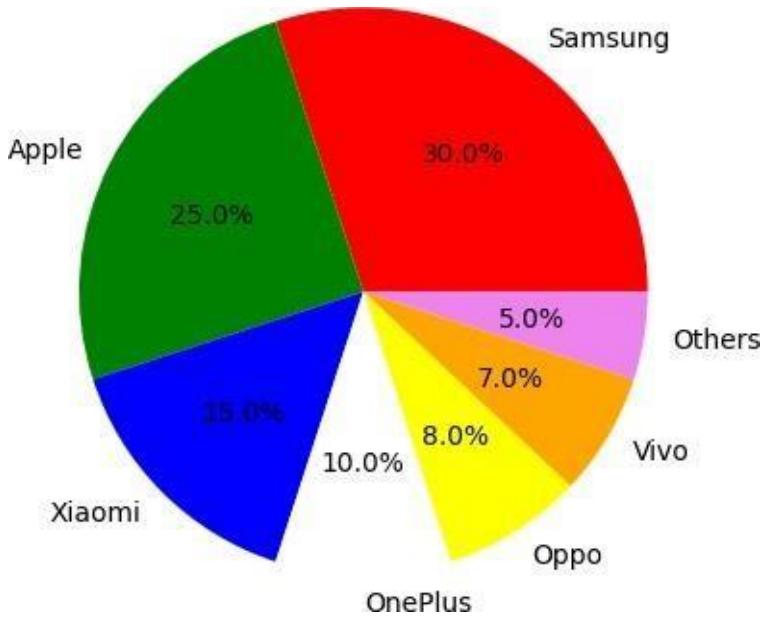
exp1f

18,

[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()
```



November 2025

[ ]:

exp2

November 18, 2025

[4]:
```
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]:
```
df.isnull().sum()
```

[7]:
```
Date        0
Product     0
Sales       0
Quantity    0
Region      0
dtype: int64
```

[13]:
```
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]:

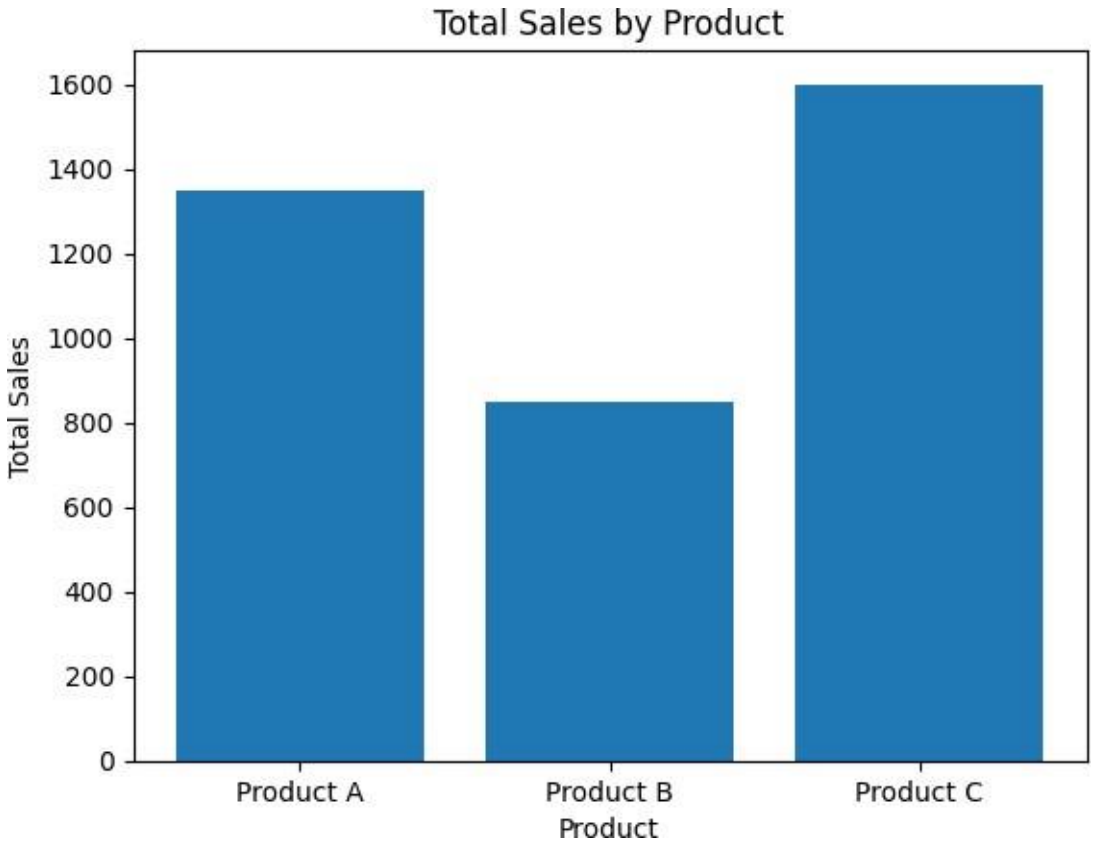
	Product	Sales	Quantity
0	Product A	1350	33
1	Product B	850	17
2	Product C	1600	36

[19]:
```
plt.figure(figsize=(10,6))
```

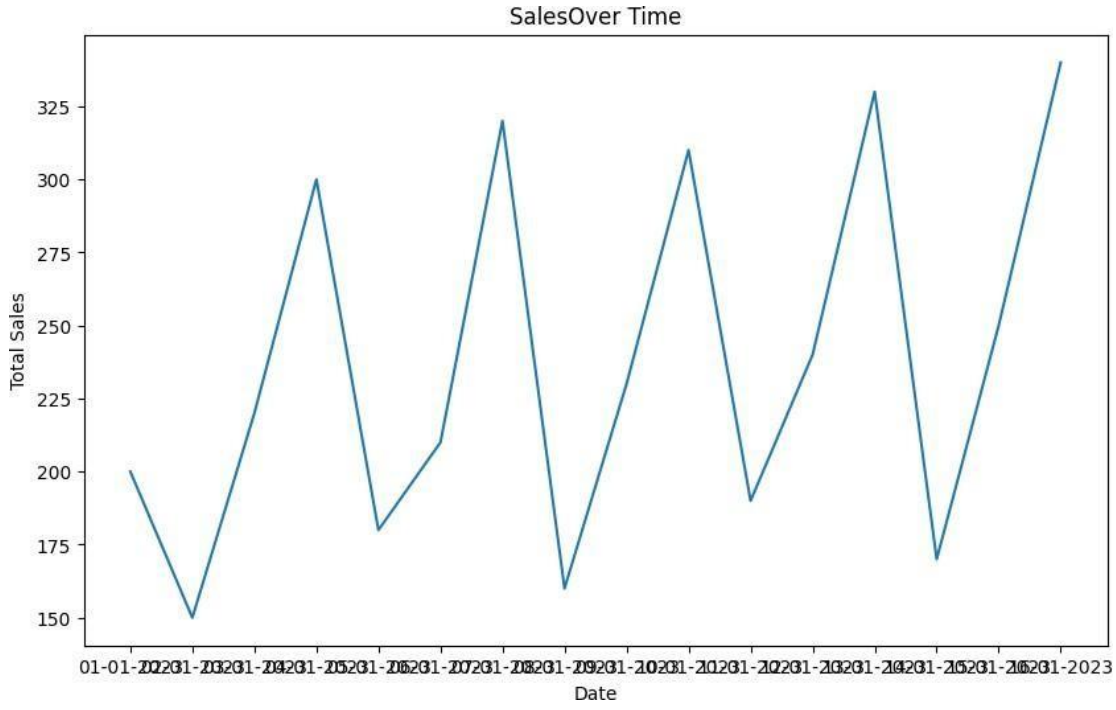
[19]: <Figure size 1000x600 with 0 Axes>

<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()
```




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

pivot_table
```

[29]:

[29]:

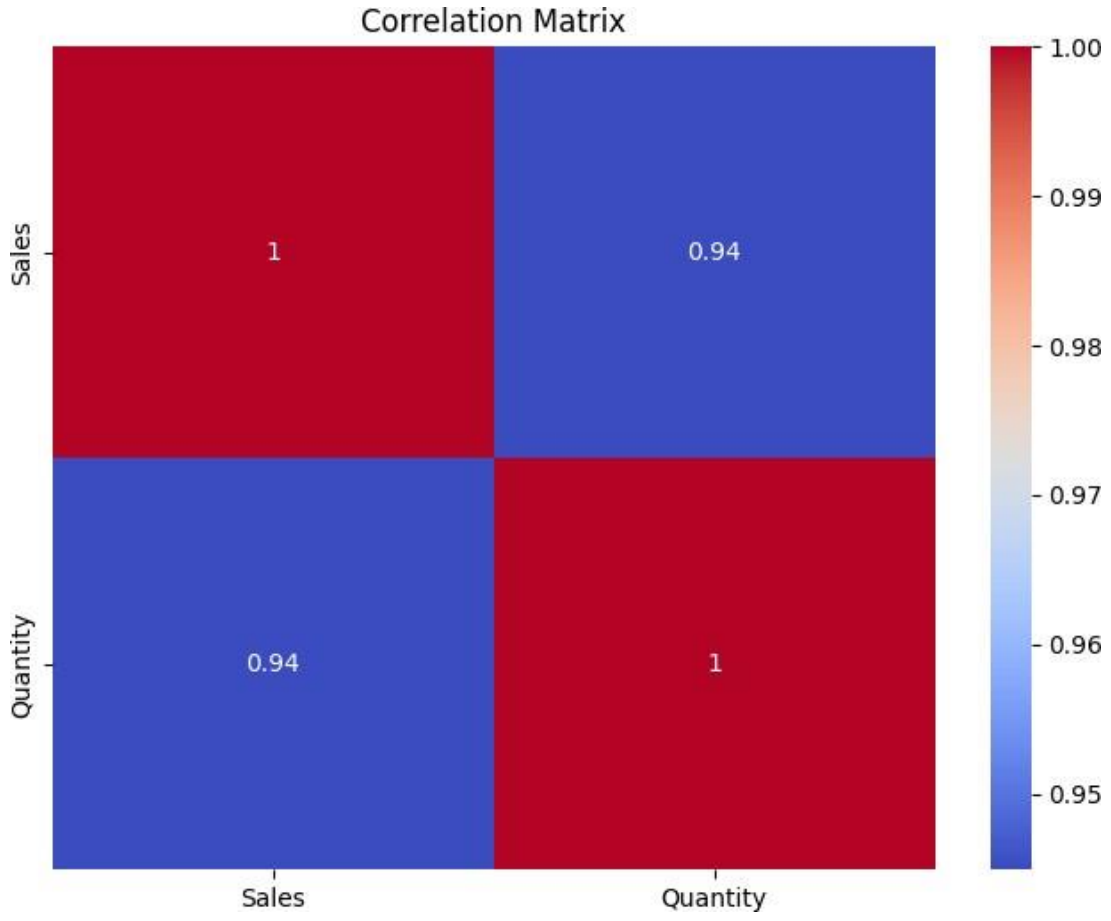
Product	Product A	Product B	Product C
Region			
East	0	0	1600
North	1350	0	0

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

November 18, 2025

[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
```

```
df.info()
```

[4] :

```
<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

78  79000.083000.0

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
```

[52]:
```
updated_dataset["Purchased"] = updated_dataset['Purchased'].replace(['No','Yes'], [0,1]).astype(int)
```

```
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

[53]:

[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

November 18, 2025

[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
```

```
df.info()
```

[47] :

```
       <class
'pandas.core.frame.DataFrame'>  RangeIndex:
```

11 entries, 0 to 10 Data columns (total 9
columns):
Column Non-Null Count Dtype

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

0 CustomerIDAge_Group 1111 nonnon--nullnull int64object 1
2 Rating(1-5) 11 non-null int64
3 Hotel 11 non-null object
4 FoodPreference 11 non-null object

5 BillNoOfPax 1111 nonnon--nullnull int64int64 6
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
df.drop_duplicates(inplace=True)
```

[48]:

	CustomerID	Age_Group	Rating(1-5)	Hotel	FoodPreference	Bill	NoOfPax	EstimatedSalary	Age_Group.1
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			

0	2			40000	20-25
1	3			59000	30-35
2	2			30000	25-30
3	2			120000	20-25
4	2	5	2	45000	35+
6		-1		122220	35+
7		-10		21122	35+
8		3		345673	20-25
				-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	3
3	4	20-25	-1	LemonTree	Veg	1234	3
4	5	35+	3	Ibis	Vegetarian	989	3
5	6	35+	3	Ibys	Non-Veg	1909	3
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	NoOfPax	EstimatedSalary
0	1.0	20-25	4.0	Ibis	veg	1300.0	2	40000.0
1	2.0	30-35	5.0	LemonTree	Non-Veg	2000.0	3	59000.0
2	3.0	25-30	6.0	RedFox	Veg	1322.0	2	30000.0
3	4.0	20-25	NaN	LemonTree	Veg	1234.0	2	120000.0
4	5.0	35+	3.0	Ibis	Vegetarian	989.0	2	45000.0
5	6.0	35+	3.0	Ibys	Non-Veg	1909.0	2	122220.0
6	7.0	35+	4.0	RedFox	Vegetarian	1000.0	-1	21122.0
7	8.0	20-25	7.0	LemonTree	Veg	2999.0	-10	345673.0
8	9.0	25-30	2.0	Ibis	Non-Veg	3456.0	3	NaN
10	10.0	30-35	5.0	RedFox	non-Veg	NaN	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       GermanyFrance
8
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()
```

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

[14] :

[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')
```

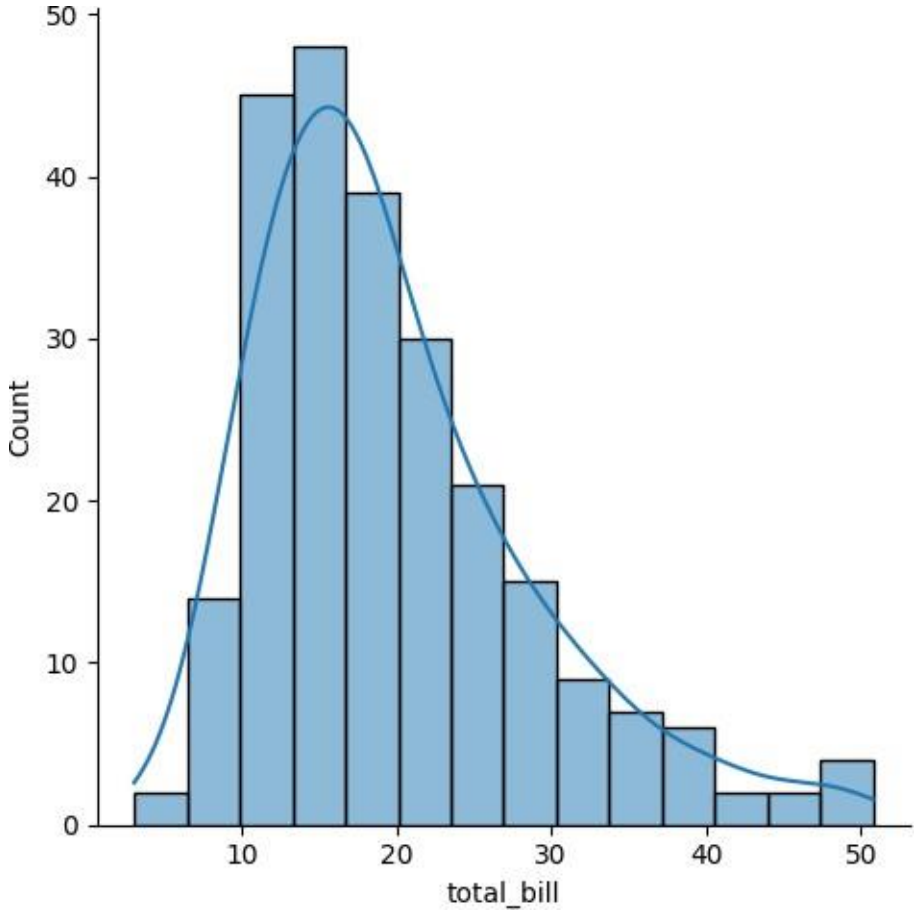
[2]:
```
tips.head()
```

[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)
```

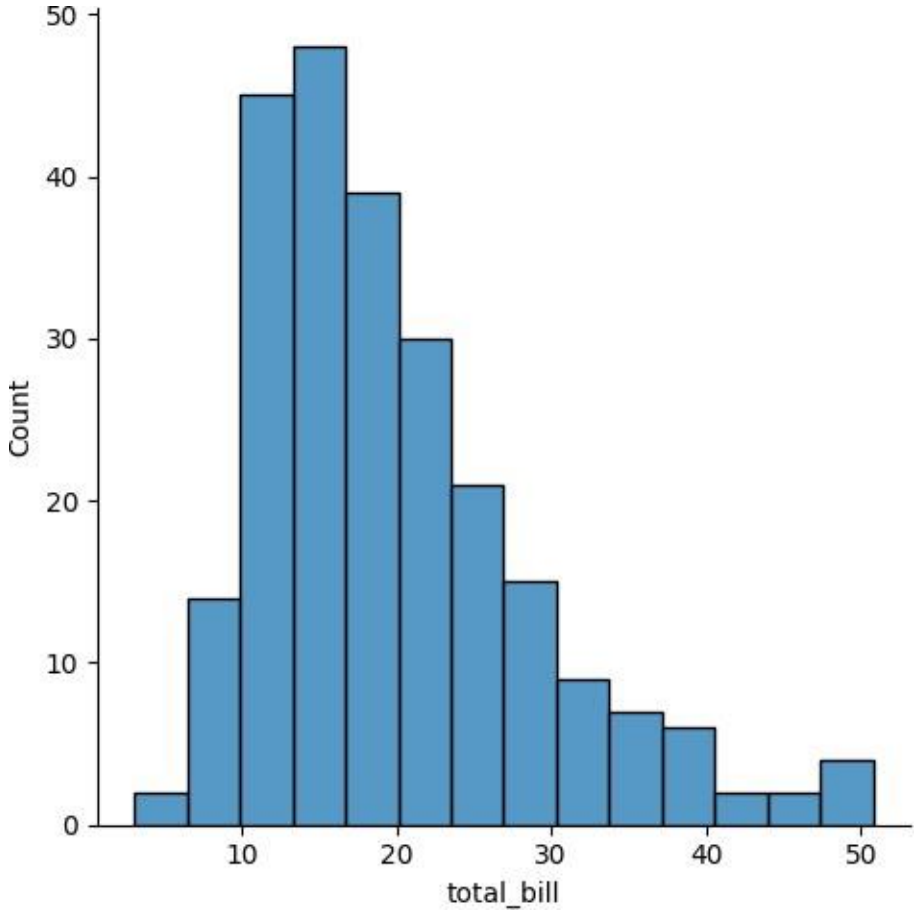
[3] : <seaborn.axisgrid.FacetGrid at 0x201fdd6a660>



[4] :

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

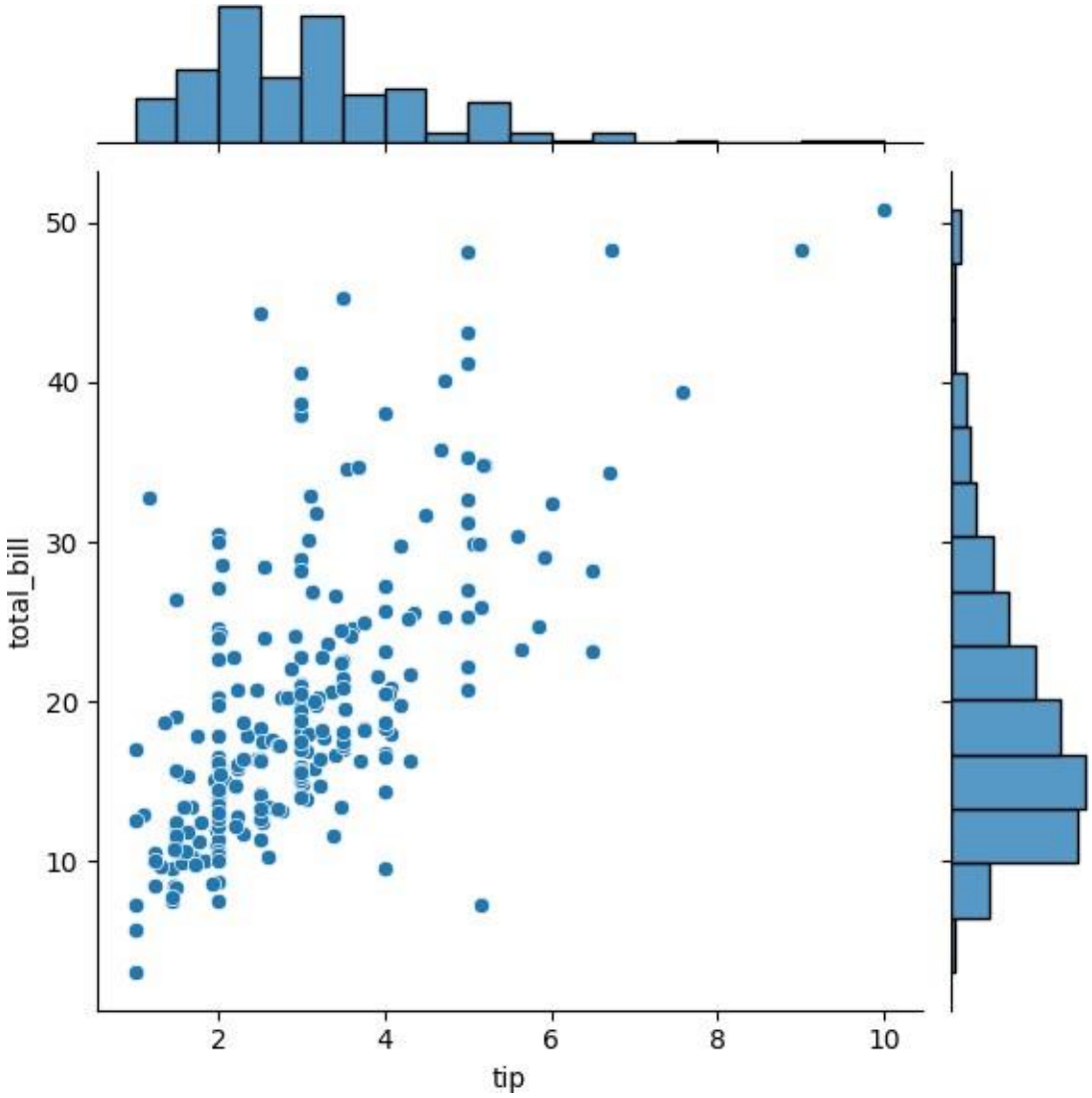
[4] : <seaborn.axisgrid.FacetGrid at 0x201fdf4b250>



[5] :

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

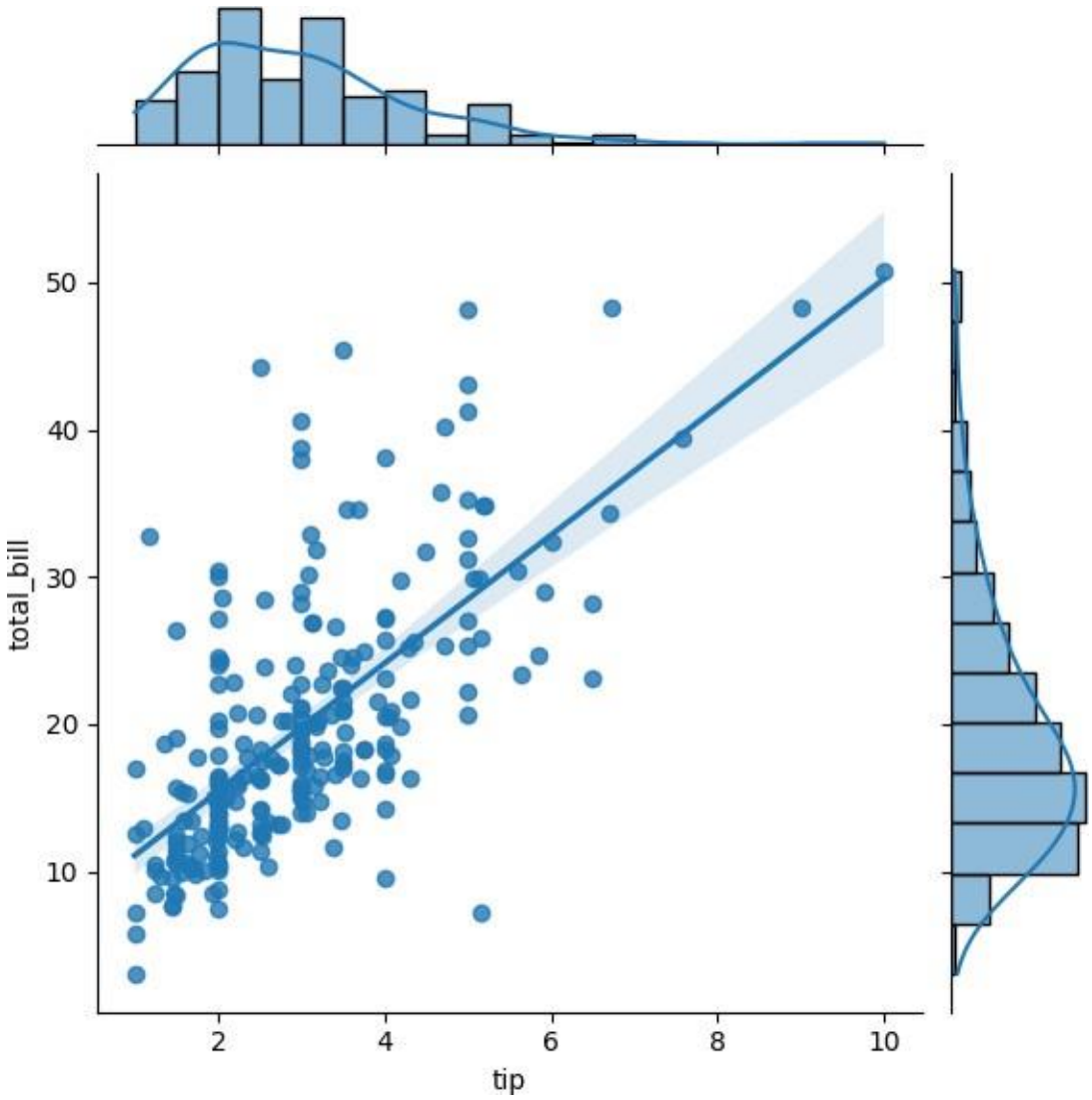
[5] : <seaborn.axisgrid.JointGrid at 0x201fdde9fd0>



[6] :

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

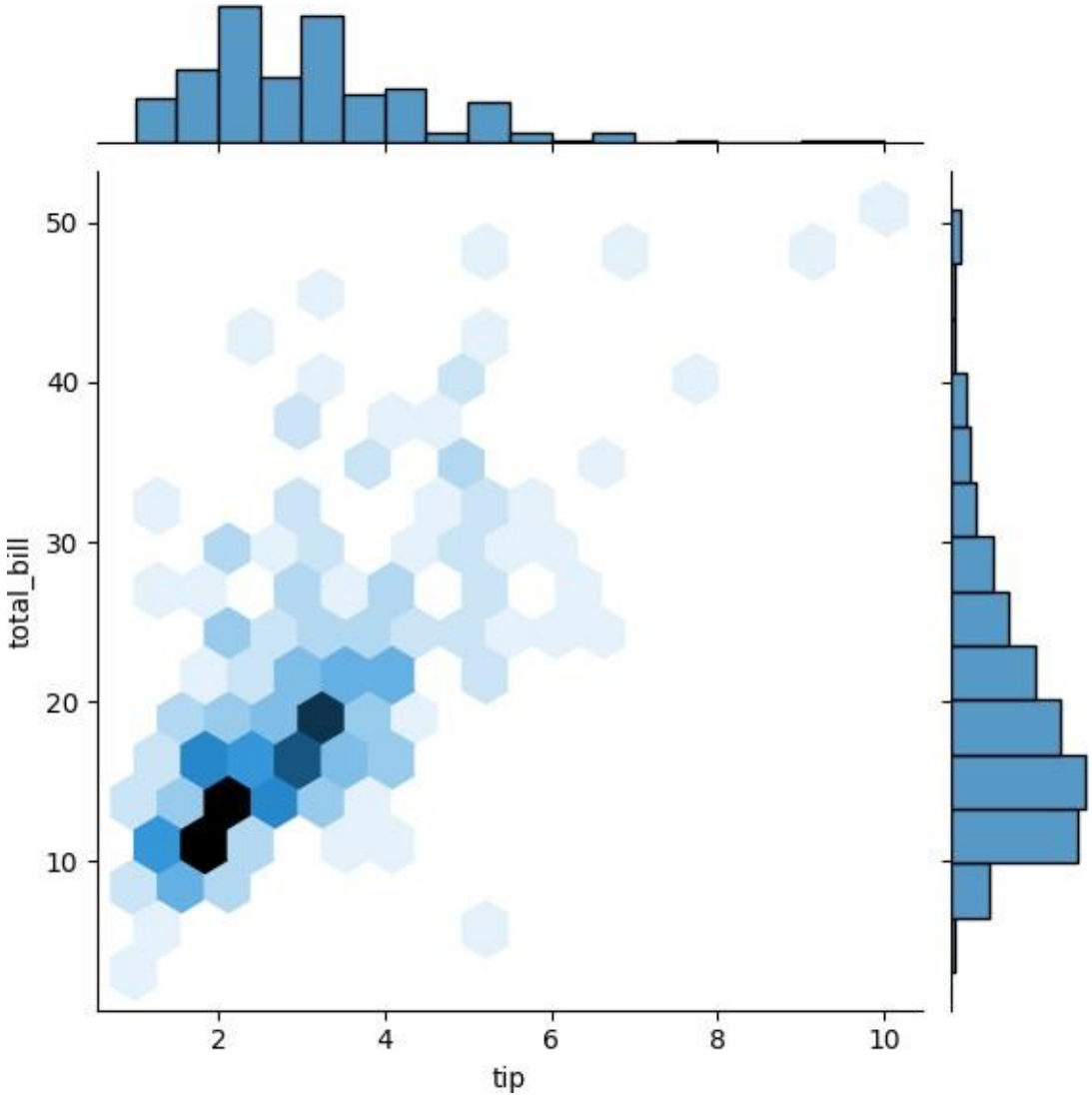
[6] : <seaborn.axisgrid.JointGrid at 0x201ff15c550>



[7] :

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

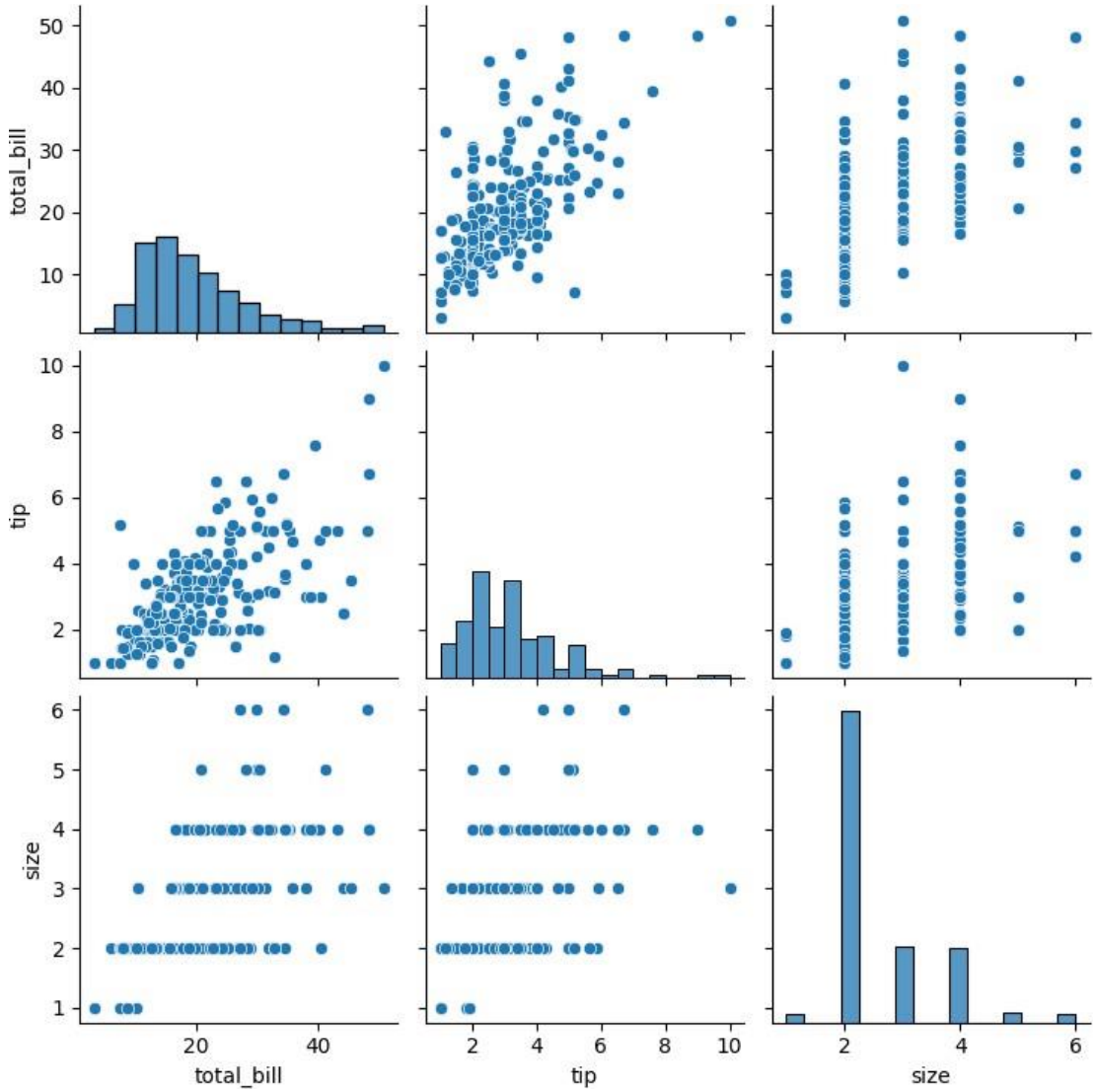
[7] : <seaborn.axisgrid.JointGrid at 0x201ff56da90>



[8] :

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

[8] : <seaborn.axisgrid.PairGrid at 0x201fddeaf90>



[9] :

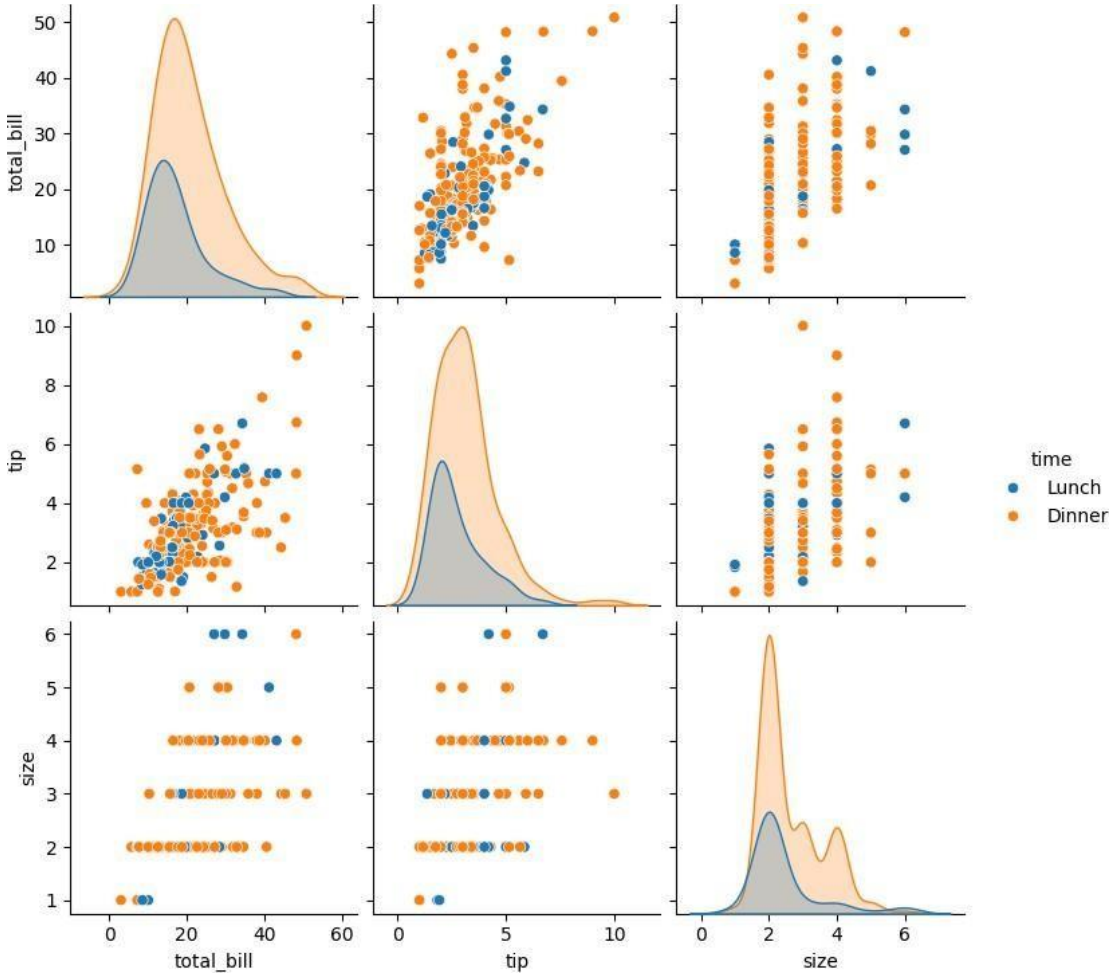
```
tips.time.value_counts()
```

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

[10]:

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

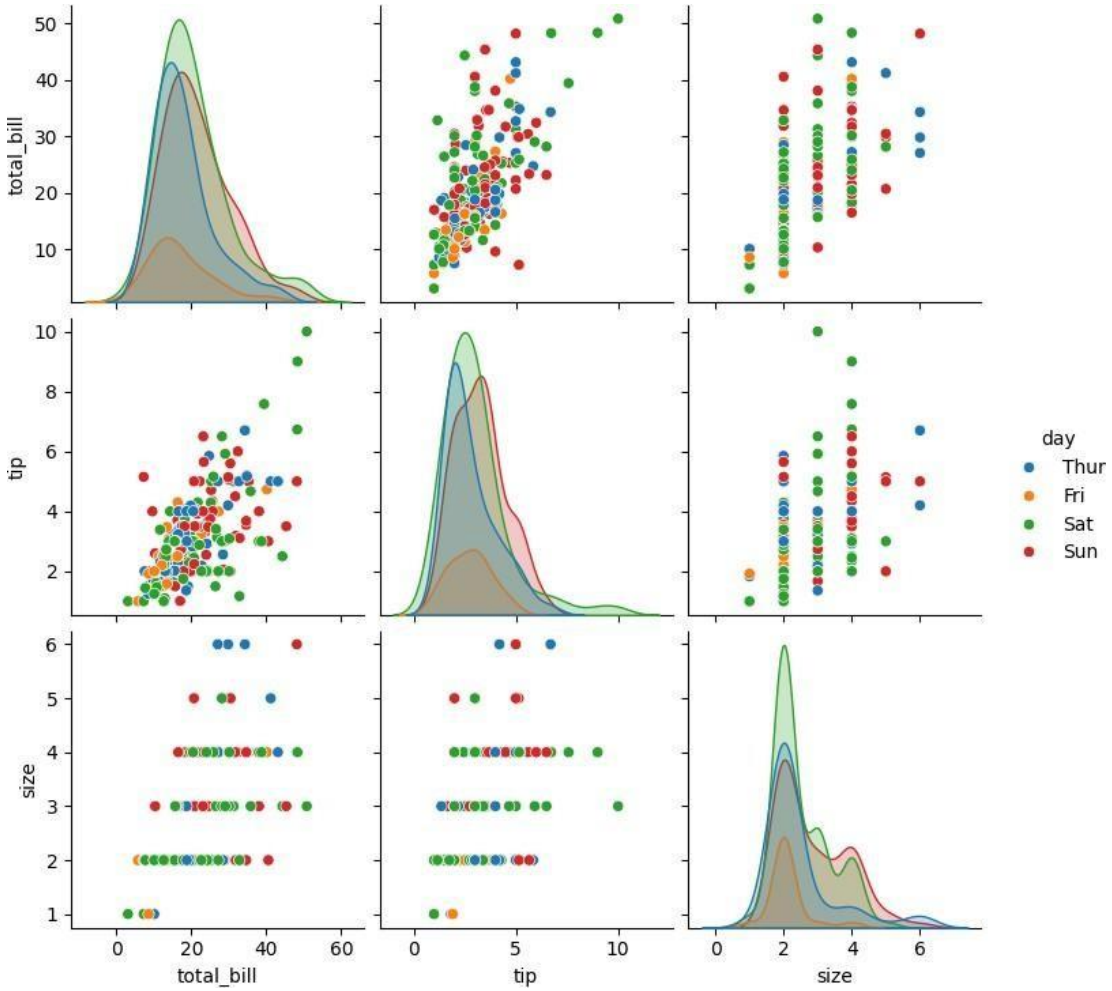
[10]: <seaborn.axisgrid.PairGrid at 0x201843e9310>



[11]:

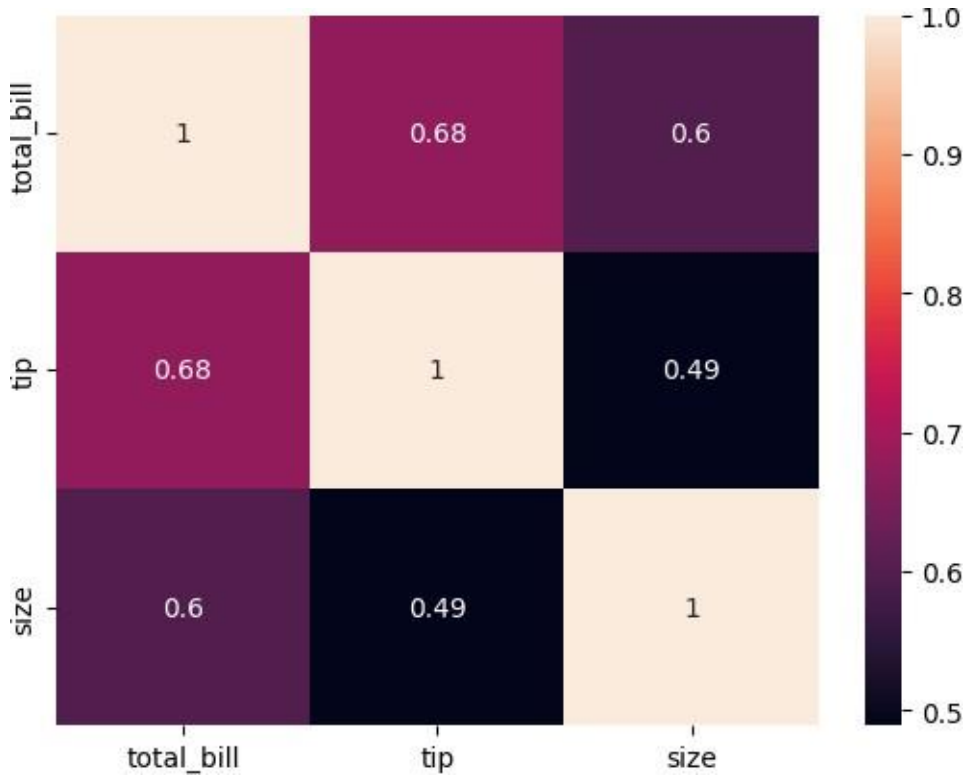
```
sns.pairplot(tips,hue='day')
```

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



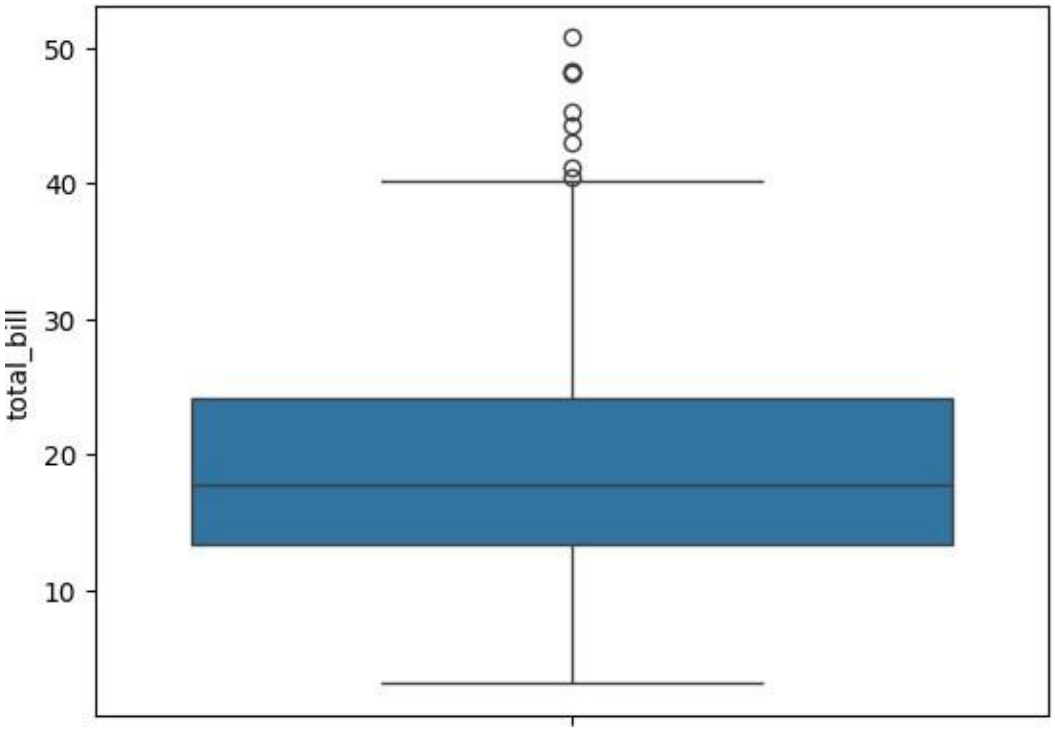
[12]:
```
sns.heatmap(tips.corr(numeric_only=True),annot=True)
```

[12]: <Axes: >



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

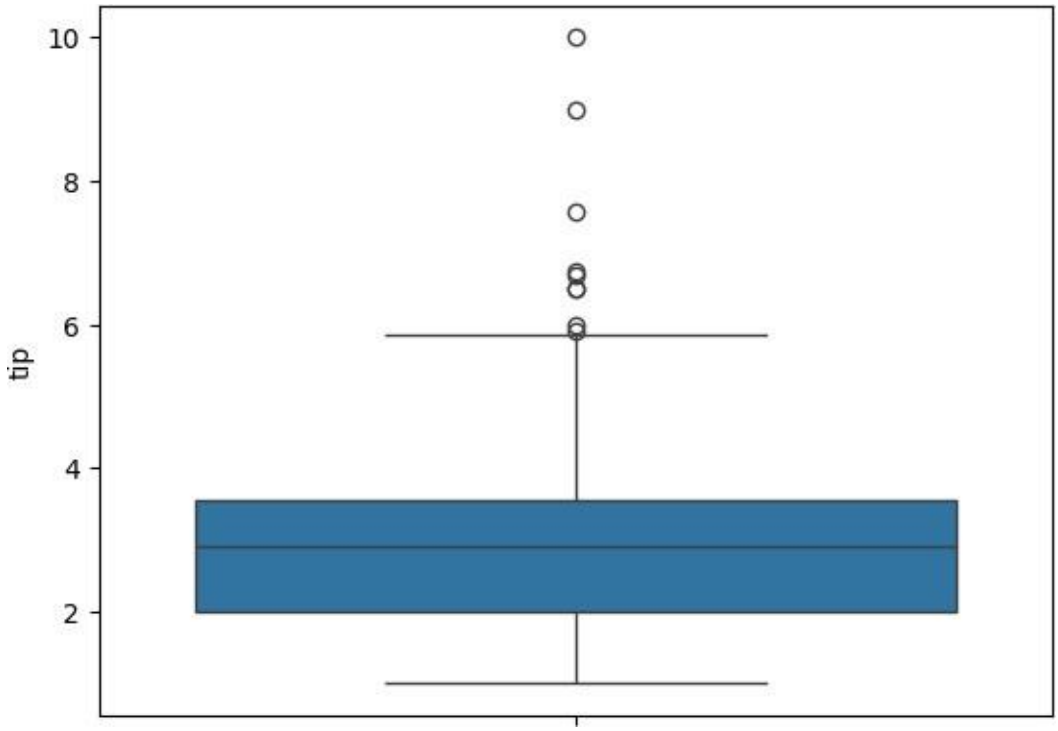
[13]: <Axes: ylabel='total_bill'>



[14]:

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

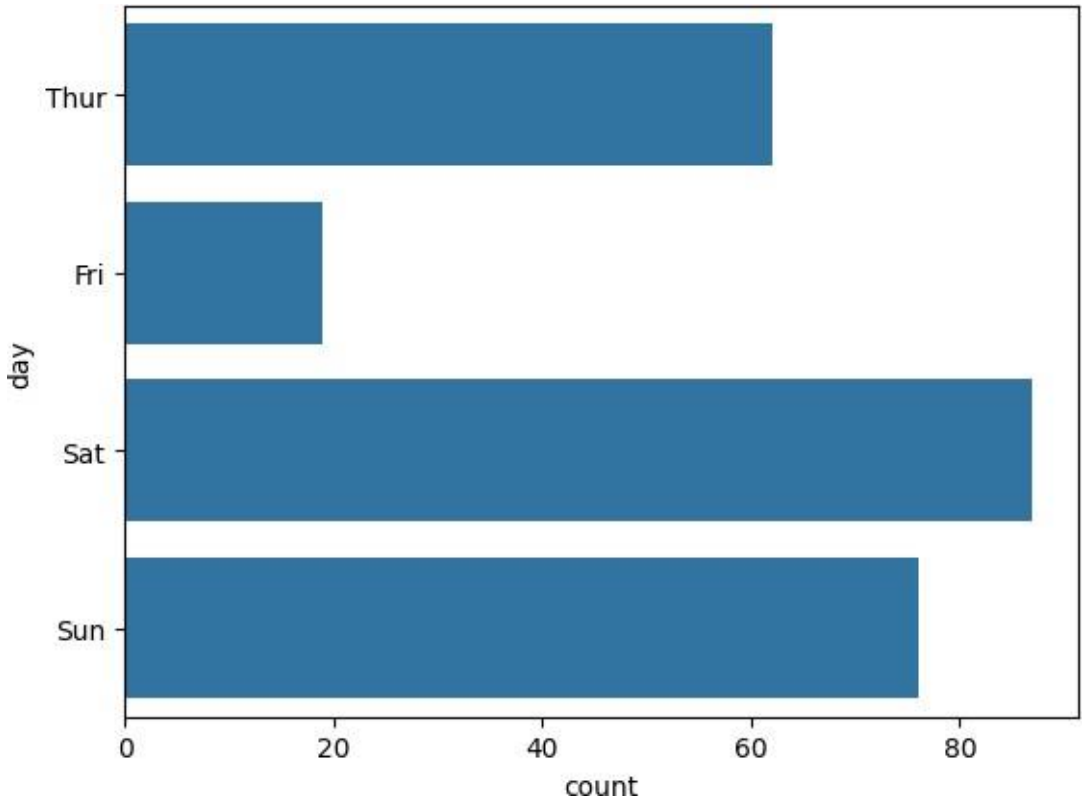
[14]: <Axes: ylabel='tip'>



[15]:

```
sns.countplot(tips.day)
```

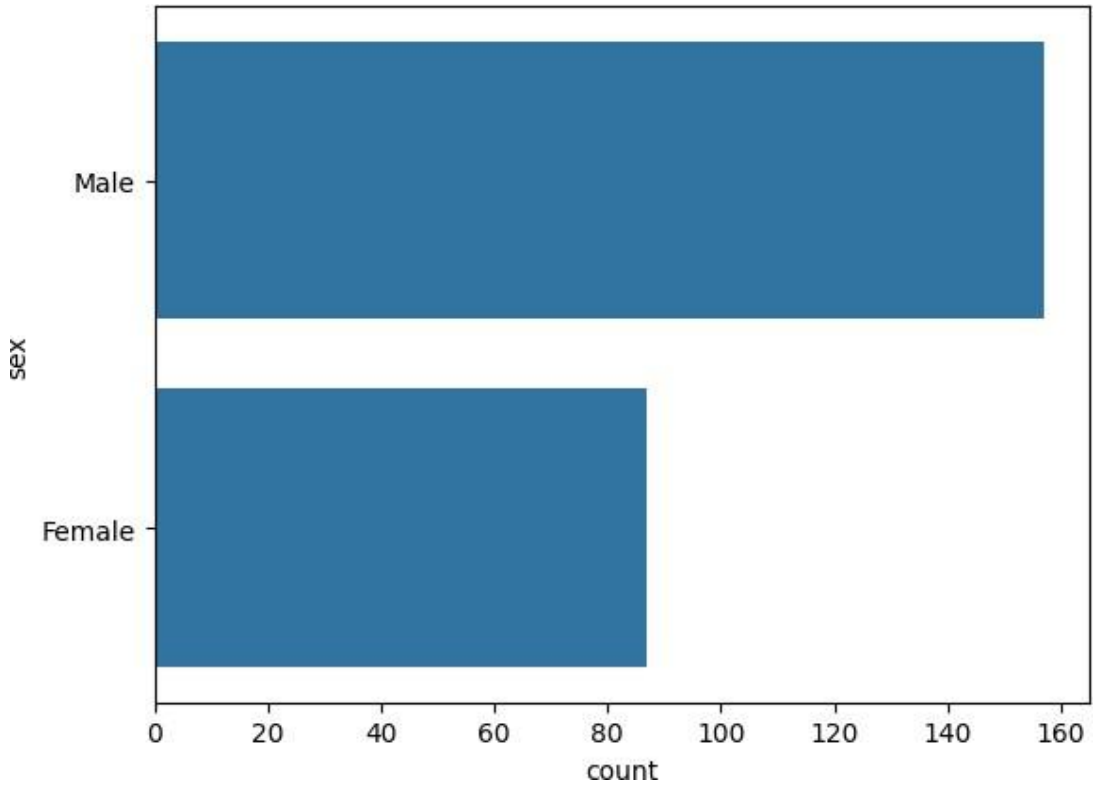
[15]: <Axes: xlabel='count', ylabel='day'>



[16]:

```
sns.countplot(tips.sex)
```

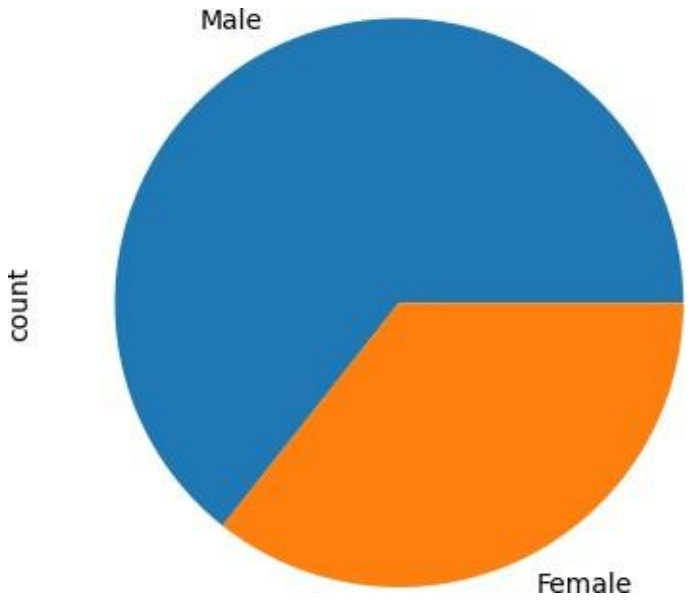
[16]: <Axes: xlabel='count', ylabel='sex'>



[17]:

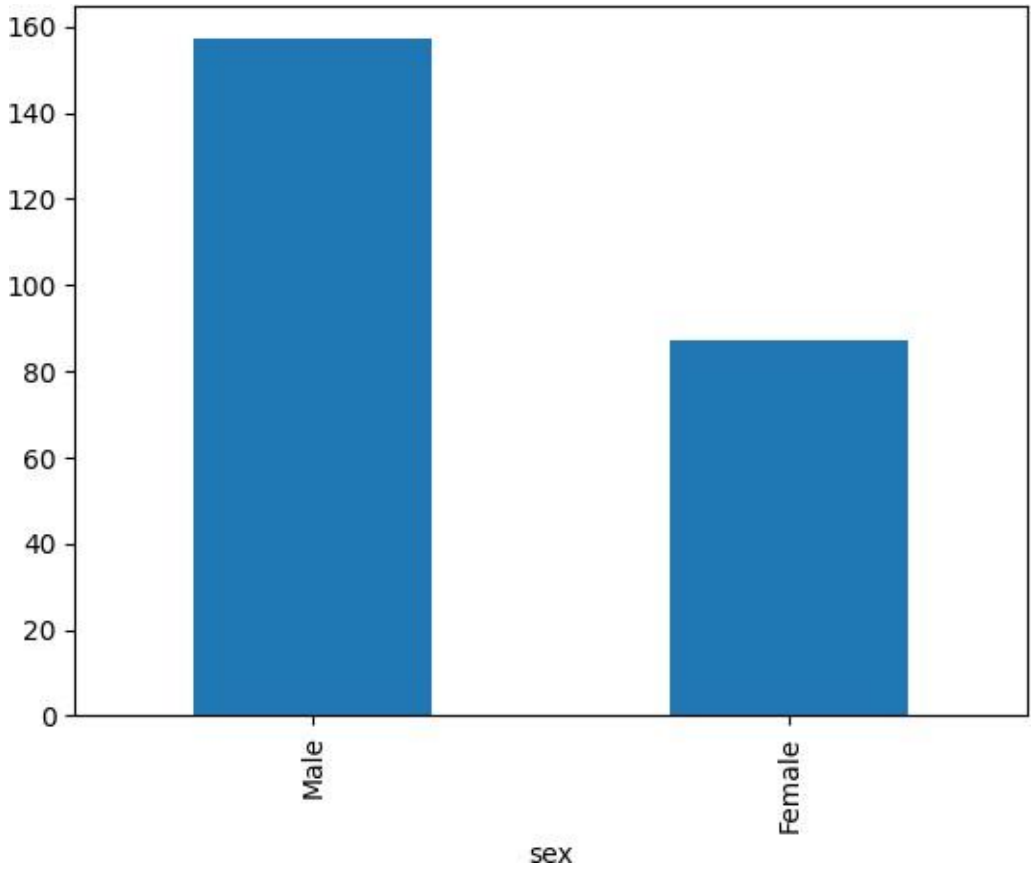
```
tips.sex.value_counts().plot(kind='pie')
```

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



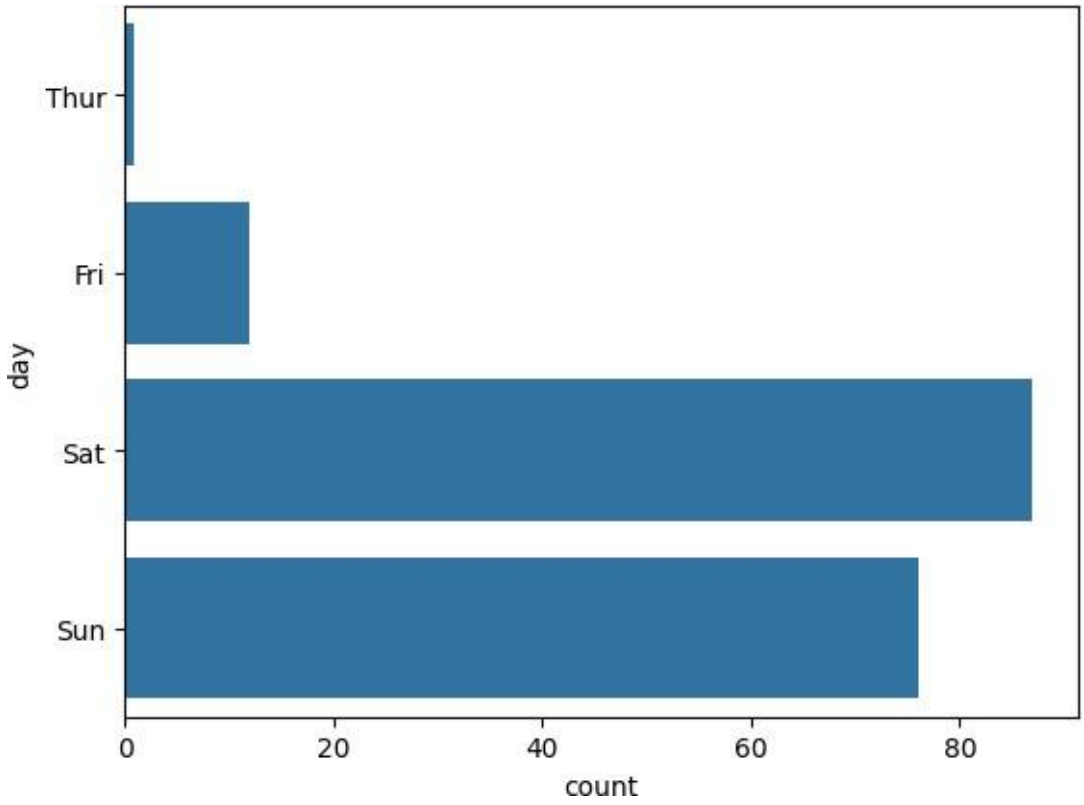
[18]:
```
tips.sex.value_counts().plot(kind='bar')
```

[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
```

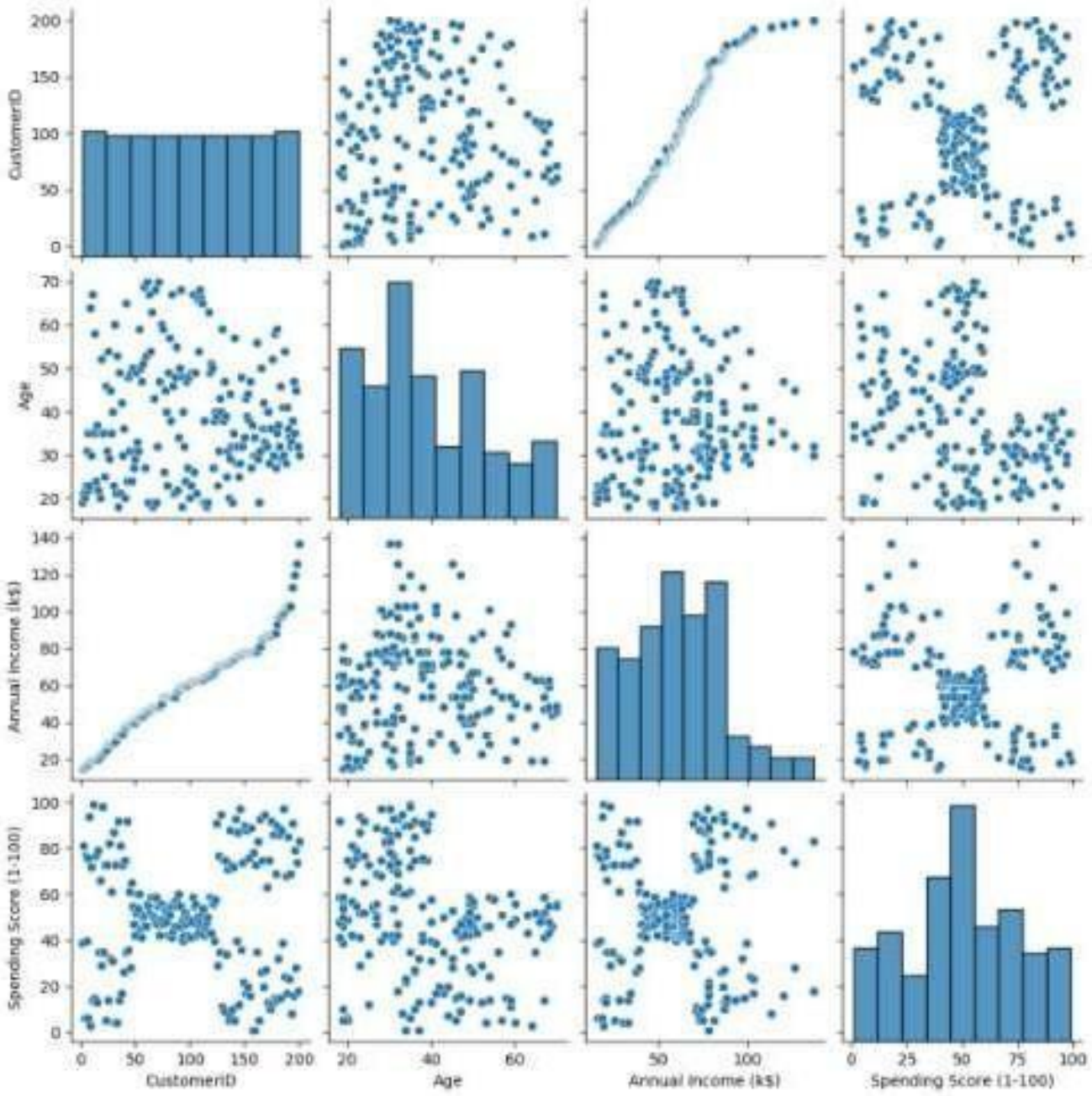
In [4]:
```
df.head()
```

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()
```

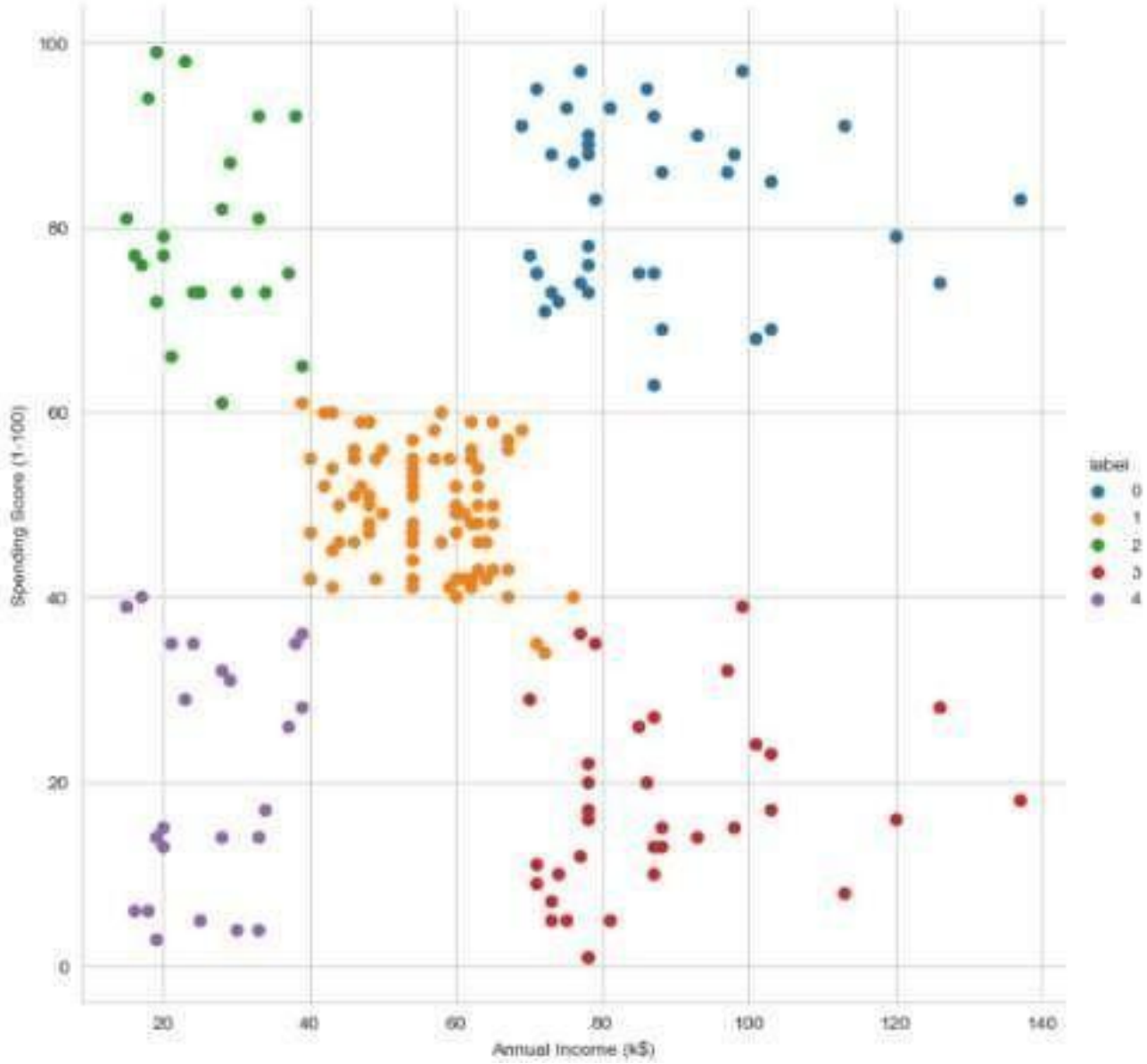
```
C:\Users\Ayyadurai\AppData\Local\Temp\ipykernel_8116\470183701.py:2: Setti
ngWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

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)
```