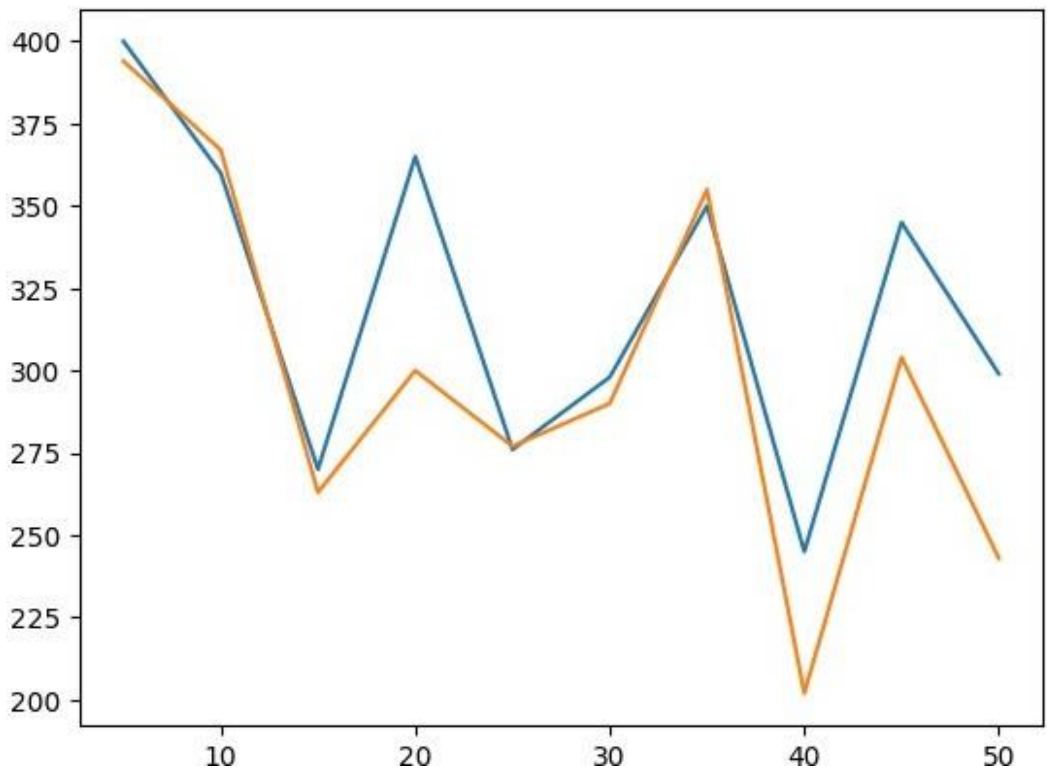
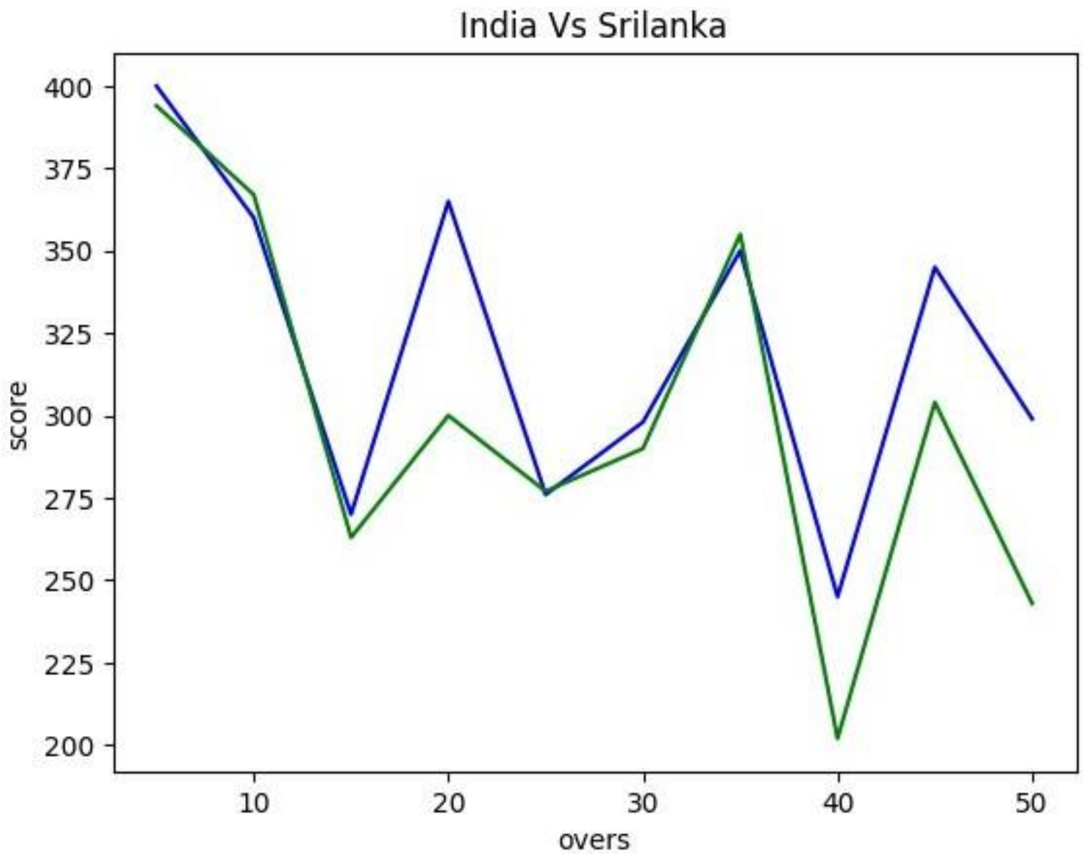
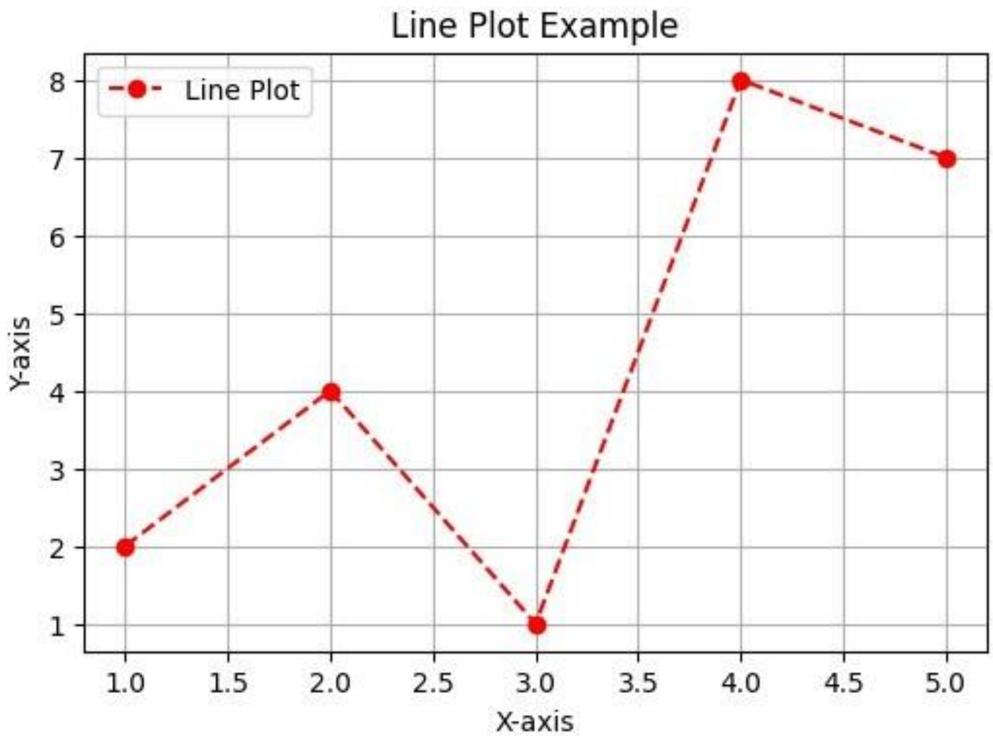
```python
#240701542
#Dhanush
Kumar.G
#17-07-25

import matplotlib.pyplot as plt
overs=list(range(5,51,5))
India_Score=[400,360,270,365,276,298,350,245,345,299]
Srilanka_Score=[394,367,263,300,277,290,355,202,304,243]
plt.plot(overs,India_Score)
plt.plot(overs,Srilanka_Score)
plt.show()
plt.title("India Vs Srilanka")
plt.xlabel("overs")
plt.ylabel("score")
plt.plot(overs,India_Score,color="blue",label="India")
plt.plot(overs,Srilanka_Score,color="green",label="Srilanga")
```



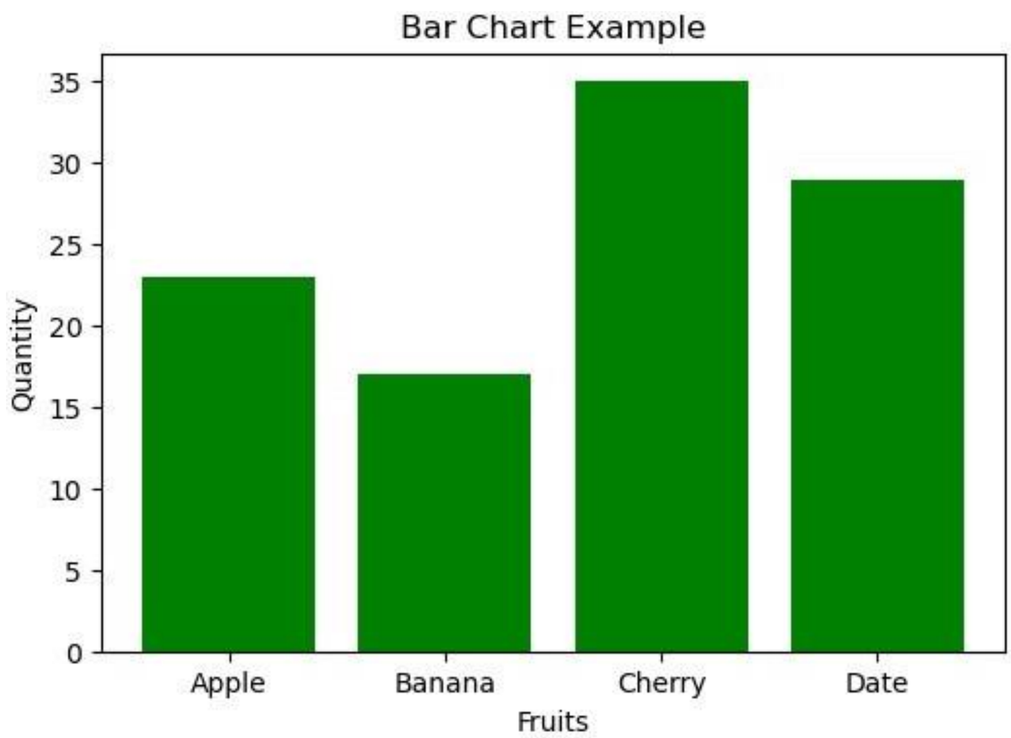

```
[<matplotlib.lines.Line2D at 0x191bd6fd720>]
```



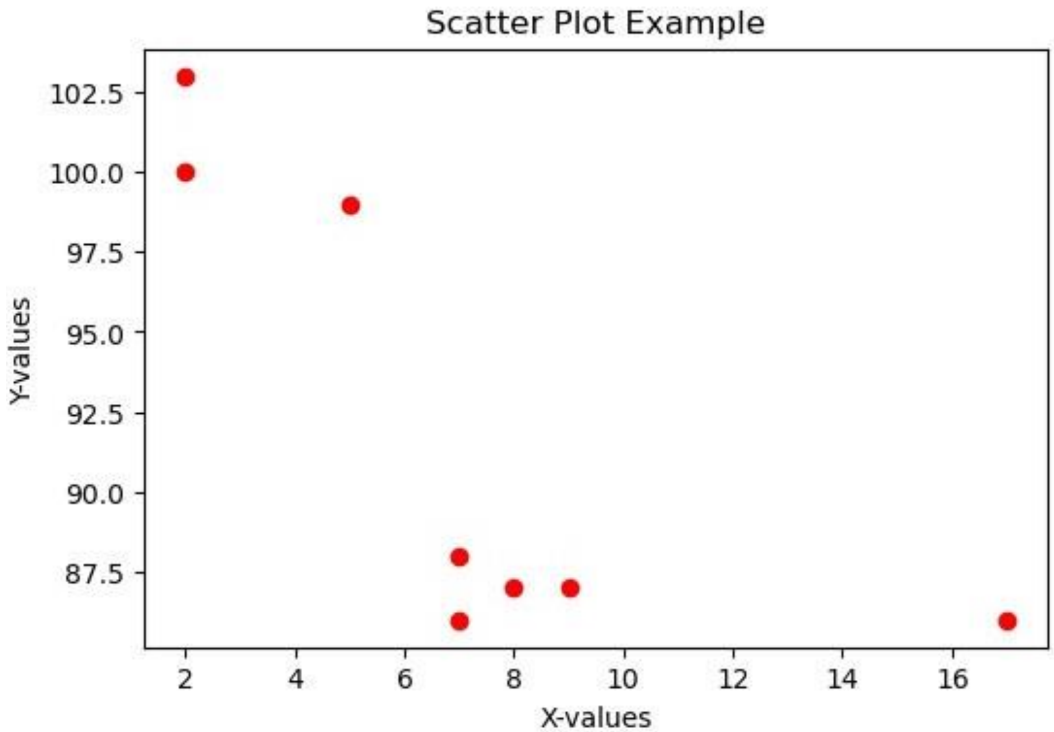

```
import matplotlib.pyplot as plt
x = [1, 2, 3, 4, 5]
y = [2, 4, 1, 8, 7]
plt.figure(figsize=(6, 4))
plt.plot(x, y, color='red', marker='o', linestyle='--', label='Line Plot')
plt.title("Line Plot Example")
plt.xlabel("X-axis")
plt.ylabel("Y-axis")
plt.legend()
plt.grid(True)
plt.show()
```



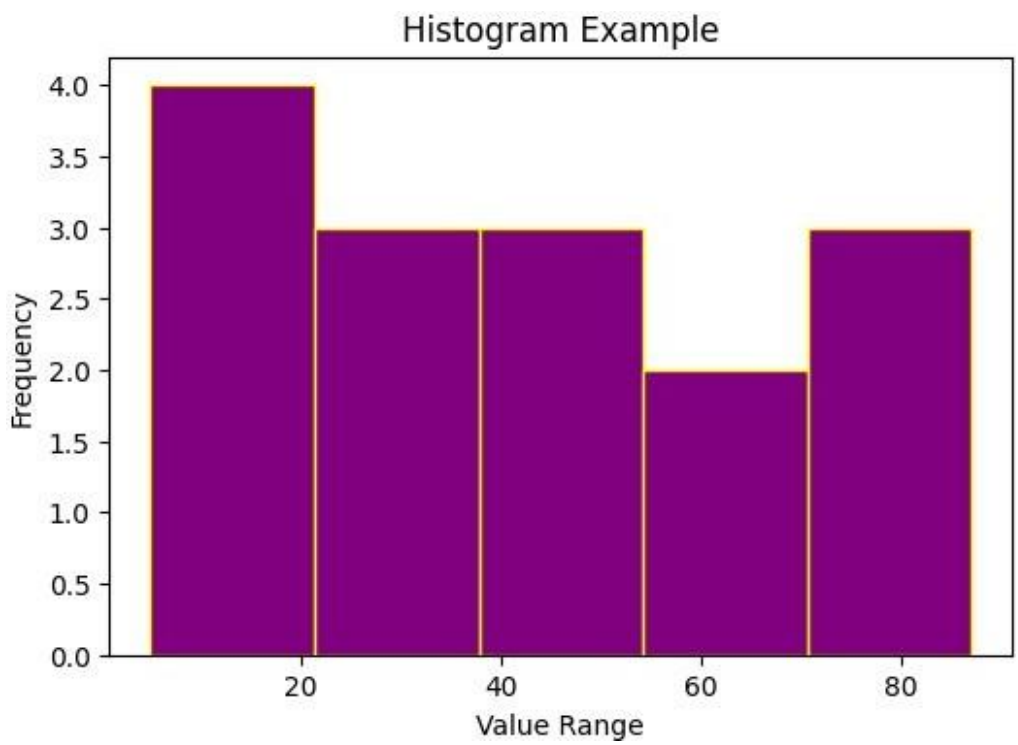

```
categories = ['Apple', 'Banana', 'Cherry', 'Date']

values = [23, 17, 35, 29]

plt.figure(figsize=(6, 4))
plt.bar(categories, values, color='green')
plt.title("Bar Chart Example")
plt.xlabel("Fruits")
plt.ylabel("Quantity")
plt.show()
```



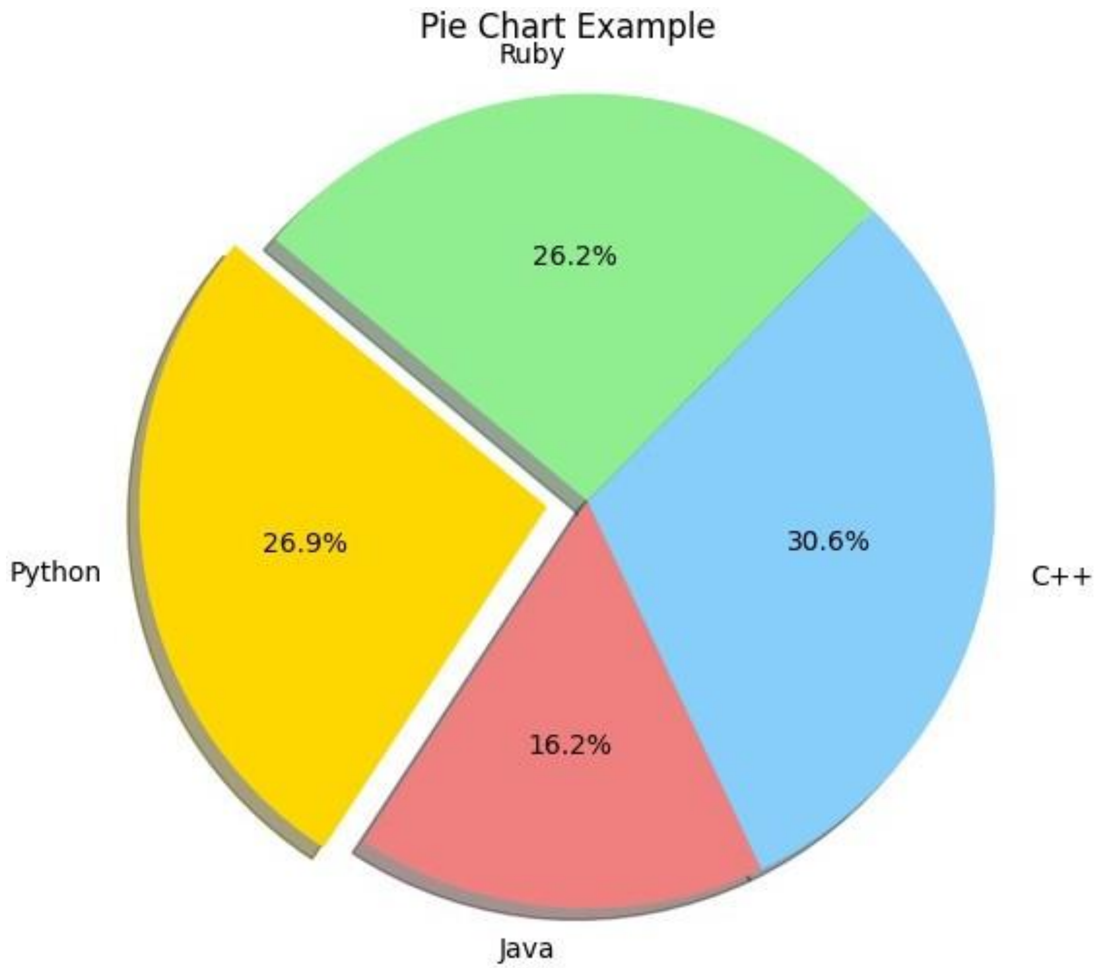

```
x_scatter = [5, 7, 8, 7, 2, 17, 2, 9]
y_scatter = [99, 86, 87, 88, 100, 86, 103, 87]
plt.figure(figsize=(6, 4))
plt.scatter(x_scatter, y_scatter, color='red')
plt.title("Scatter Plot Example")
plt.xlabel("X-values")
plt.ylabel("Y-values")

plt.show()
```




```
data = [22, 87, 5, 43, 56, 73, 55, 54, 11, 20, 51, 5, 79, 31, 27]
plt.figure(figsize=(6, 4))
plt.hist(data, bins=5, color='purple', edgecolor='yellow')
plt.title("Histogram Example")
plt.xlabel("Value Range")
plt.ylabel("Frequency")
plt.show()
```




```
labels = ['Python', 'Java', 'C++', 'Ruby']
sizes = [215, 130, 245, 210]
colors = ['gold', 'lightcoral', 'lightskyblue', 'lightgreen']
explode = (0.1, 0, 0, 0)
plt.figure(figsize=(6, 6))
plt.pie(sizes, explode=explode, labels=labels,
colors=colors,autopct='%1.1f%%',
shadow=True, startangle=140)
plt.title("Pie Chart Example")
plt.axis('equal')
plt.show()
```




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

df = pd.read_csv('sales_data.csv')

print(df.head())

print(df.isnull().sum())

df['Sales'] = df['Sales'].fillna(df['Sales'].mean())

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

df
```

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

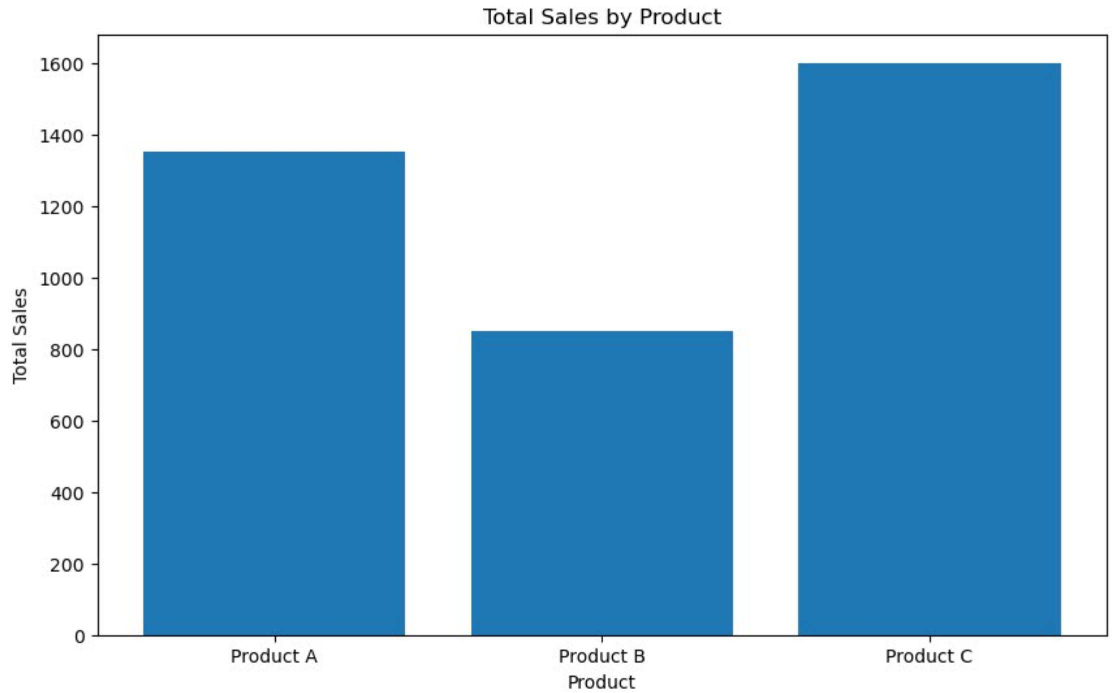
```
3   04-01-2023   Product C     300           6    East
4   05-01-2023   Product B     180           4    West
Date          0
Product       0
Sales         0
Quantity      0
Region        0
dtype: int64
```

```
          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
```

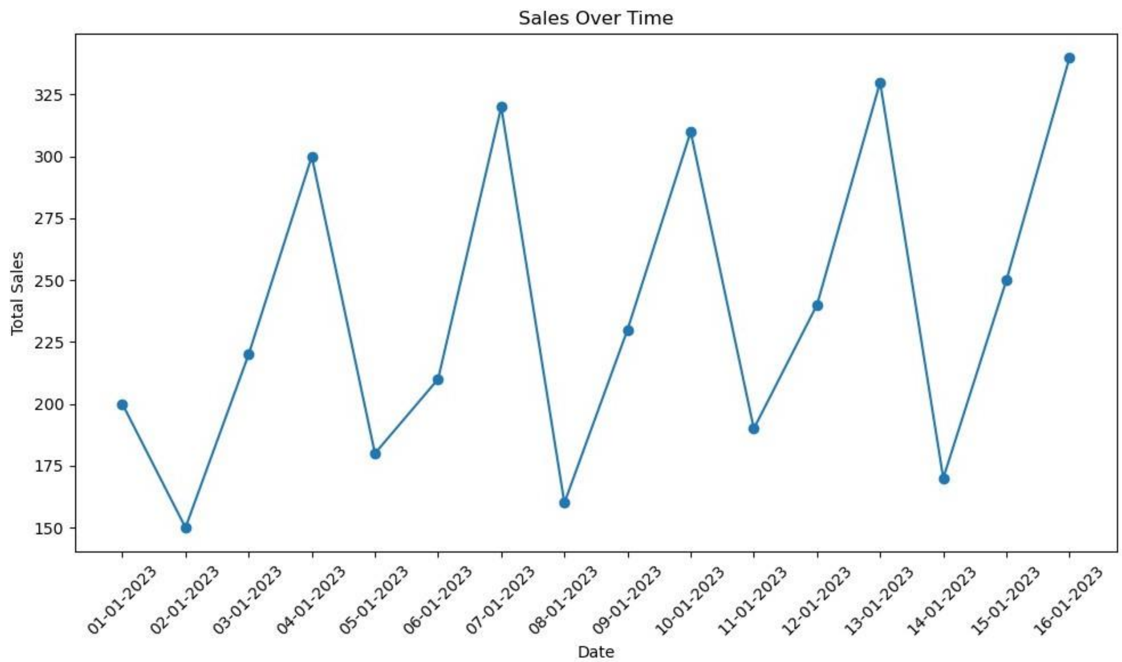
```
product_summary = df.groupby('Product').agg({
'Sales': 'sum',
'Quantity': 'sum'
}).reset_index()
print(product_summary)
```

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

```
plt.figure(figsize=(10, 6))
plt.bar(product_summary['Product'], product_summary['Sales'])
plt.xlabel('Product')
plt.ylabel('Total Sales')
plt.title('Total Sales by Product')
plt.show()
```



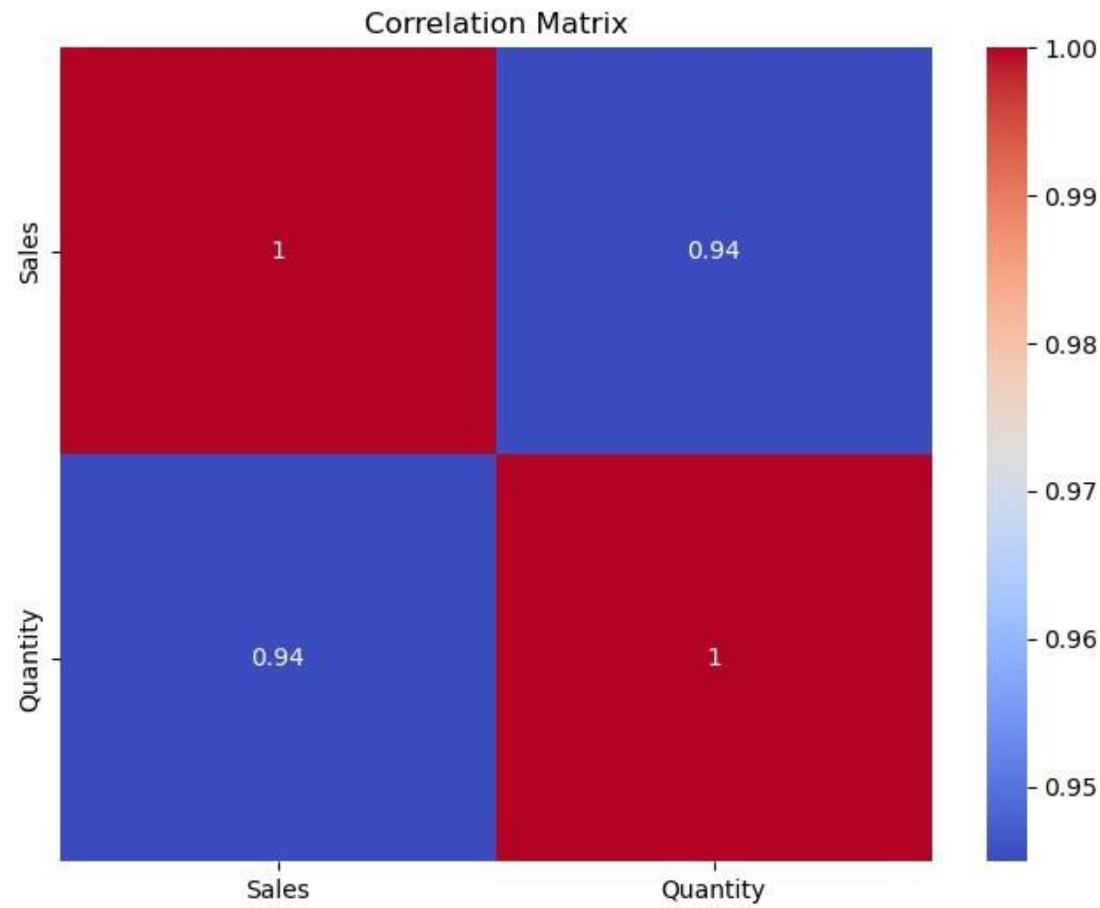

```
df = df.dropna(subset=['Date'])
sales_over_time = df.groupby('Date', as_index=False)['Sales'].sum()
plt.figure(figsize=(10, 6))
plt.plot(sales_over_time['Date'], sales_over_time['Sales'], marker='o')
plt.xlabel('Date')
plt.ylabel('Total Sales')
plt.title('Sales Over Time')
plt.xticks(rotation=45)
plt.tight_layout()
plt.show()
```




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

# Only correlate numeric columns
correlation_matrix = df.select_dtypes(include=['number']).corr()
print(correlation_matrix)
```

```
Product  Product A  Product B  Product C
Region
East             0          0       1600
North         1350          0          0
South            0        480          0
West             0        370          0
             Sales  Quantity
Sales     1.000000  0.944922
Quantity  0.944922  1.000000
```

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




```
import numpy as np
import pandas as pd
df=pd.read_csv("Hotel_Dataset.csv")
df
```

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

```
df.duplicated()
```

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

```
df.info()
```

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

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

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

```
2            3    25-30             6      RedFox            Veg   1322
3            4    20-25            -1   LemonTree            Veg   1234
4            5      35+             3        Ibis     Vegetarian    989
5            6      35+             3        Ibys        Non-Veg   1909
6            7      35+             4      RedFox     Vegetarian   1000
7            8    20-25             7   LemonTree            Veg   2999
8            9    25-30             2        Ibis        Non-Veg   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
```

```
len(df)
```

```
10
```

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

```
array([0, 1, 2, 3, 4, 5, 6, 7, 8, 9])
```

```
df
```

```
   CustomerID Age_Group  Rating(1-5)      Hotel 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
```

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

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

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

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

```
   CustomerID Age_Group  Rating(1-5)      Hotel FoodPreference    Bill  \
0         1.0     20-25            4       Ibis            veg  1300.0
1         2.0     30-35            5  LemonTree        Non-Veg  2000.0
2         3.0     25-30            6     RedFox            Veg  1322.0
3         4.0     20-25           -1  LemonTree            Veg  1234.0
4         5.0       35+            3       Ibis     Vegetarian   989.0
5         6.0       35+            3       Ibys        Non-Veg  1909.0
6         7.0       35+            4     RedFox     Vegetarian  1000.0
7         8.0     20-25            7  LemonTree            Veg  2999.0
8         9.0     25-30            2       Ibis        Non-Veg  3456.0
9        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.loc[(df['NoOfPax'] < 1) | (df['NoOfPax'] > 20), 'NoOfPax'] = np.nan
df
```

```
   CustomerID Age_Group  Rating(1-5)      Hotel FoodPreference    Bill  \
0         1.0     20-25            4       Ibis            veg  1300.0
1         2.0     30-35            5  LemonTree        Non-Veg  2000.0
2         3.0     25-30            6     RedFox            Veg  1322.0
3         4.0     20-25           -1  LemonTree            Veg  1234.0
4         5.0       35+            3       Ibis     Vegetarian   989.0
5         6.0       35+            3       Ibys        Non-Veg  1909.0
6         7.0       35+            4     RedFox     Vegetarian  1000.0
7         8.0     20-25            7  LemonTree            Veg  2999.0
8         9.0     25-30            2       Ibis        Non-Veg  3456.0
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
4      2.0          45000.0
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()
```

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

```
df['Hotel'] = df['Hotel'].replace(['Ibys'],'Ibis')
df.FoodPreference.unique()
```

```
array(['veg', 'Non-Veg', 'Veg', 'Vegetarian', 'non-Veg'], dtype=object)
```

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

```
C:\Users\Dhanush Kumar\AppData\Local\Temp\ipykernel_23860\3377581060.py:1:
FutureWarning: A value is trying to be set on a copy of a DataFrame or Series
through chained assignment using an inplace method.
The behavior will change in pandas 3.0. This inplace method will never work
because the intermediate object on which we are setting values always behaves
as a copy.

For example, when doing 'df[col].method(value, inplace=True)', try using
'df.method({col: value}, inplace=True)' or df[col] = df[col].method(value)
instead, to perform the operation inplace on the original object.


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

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

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

```
import numpy as np

import pandas as pd

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

df

   Country   Age   Salary Purchased

0   France  44.0  72000.0        No

1    Spain  27.0  48000.0       Yes

2  Germany  30.0  54000.0        No

3    Spain  38.0  61000.0        No

4  Germany  40.0      NaN       Yes

5   France  35.0  58000.0       Yes

6    Spain   NaN  52000.0        No

7   France  48.0  79000.0       Yes

8  Germany  50.0  83000.0        No

9   France  37.0  67000.0       Yes

df.info()

<class 'pandas.core.frame.DataFrame'>

RangeIndex: 10 entries, 0 to 9

Data columns (total 4 columns):

 #   Column     Non-Null Count  Dtype

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

 0   Country    10 non-null     object

 1   Age        9 non-null      float64

 2   Salary     9 non-null      float64

 3   Purchased  10 non-null     object

dtypes: float64(2), object(2)

memory usage: 448.0+ bytes
```

df.Country.mode()

0   France

Name: Country, dtype: object

df.Country.mode()[0]

'France'

type(df.Country.mode())

pandas.core.series.Series

df.Country.fillna(df.Country.mode()[0],inplace=True)

df.Age.fillna(df.Age.median(),inplace=True)

df.Salary.fillna(round(df.Salary.mean()),inplace=True)

df

C:\Users\Dhanush Kumar\AppData\Local\Temp\ipykernel_19496\1020198583.py:1: FutureWarning: A value is trying to be set on a copy of a DataFrame or Series through chained assignment using an inplace method.

The behavior will change in pandas 3.0. This inplace method will never work because the intermediate object on which we are setting values always behaves as a copy.

For example, when doing 'df[col].method(value, inplace=True)', try using 'df.method({col: value}, inplace=True)' or df[col] = df[col].method(value) instead, to perform the operation inplace on the original object.

  df.Country.fillna(df.Country.mode()[0],inplace=True)

C:\Users\Dhanush Kumar\AppData\Local\Temp\ipykernel_19496\1020198583.py:2: FutureWarning: A value is trying to be set on a copy of a DataFrame or Series through chained assignment using an inplace method.

The behavior will change in pandas 3.0. This inplace method will never work because the intermediate object on which we are setting values always behaves as a copy.

For example, when doing 'df[col].method(value, inplace=True)', try using 'df.method({col: value}, inplace=True)' or df[col] = df[col].method(value) instead, to perform the operation inplace on the original object.

```
df.Age.fillna(df.Age.median(),inplace=True)
```

C:\Users\Dhanush Kumar\AppData\Local\Temp\ipykernel_19496\1020198583.py:3: FutureWarning: A value is trying to be set on a copy of a DataFrame or Series through chained assignment using an inplace method.

The behavior will change in pandas 3.0. This inplace method will never work because the intermediate object on which we are setting values always behaves as a copy.

For example, when doing 'df[col].method(value, inplace=True)', try using 'df.method({col: value}, inplace=True)' or df[col] = df[col].method(value) instead, to perform the operation inplace on the original object.

```
df.Salary.fillna(round(df.Salary.mean()),inplace=True)
```

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

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

```
   France  Germany  Spain
0    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
```

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

```
   France  Germany  Spain   Age   Salary Purchased
0    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  38.0  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
```

```
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 
dtypes: float64(2), object(2)
memory usage: 448.0+ bytes
```

```
updated_dataset.Purchased.replace(['No','Yes'],[0,1],inplace=True)
updated_dataset
```

C:\Users\Dhanush Kumar\AppData\Local\Temp\ipykernel_19496\3486364662.py:1: FutureWarning: A value is trying to be set on a copy of a DataFrame or Series through chained assignment using an inplace method.

The behavior will change in pandas 3.0. This inplace method will never work because the intermediate object on which we are setting values always behaves as a copy.

For example, when doing 'df[col].method(value, inplace=True)', try using 'df.method({col: value}, inplace=True)' or df[col] = df[col].method(value) instead, to perform the operation inplace on the original object.

```
  updated_dataset.Purchased.replace(['No','Yes'],[0,1],inplace=True)
```

C:\Users\Dhanush Kumar\AppData\Local\Temp\ipykernel_19496\3486364662.py:1: FutureWarning: Downcasting behavior in `replace` is deprecated and will be removed in a future version. To retain the old behavior, explicitly call `result.infer_objects(copy=False)`. To opt-in to the future behavior, set `pd.set_option('future.no_silent_downcasting', True)`

```
  updated_dataset.Purchased.replace(['No','Yes'],[0,1],inplace=True)
```

	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	38.0	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

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

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

```
df.head()
```

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

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

```
features
label
```

```
array(['No', 'Yes', 'No', 'No', 'Yes', 'Yes', 'No', 'Yes', 'No', 'Yes'],
      dtype=object)
```

```
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]])
```

```
SimpleImputer()
```

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

```
SimpleImputer()
```

```
SimpleImputer()
```

```
SimpleImputer()
```

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

```
array([['France', 44.0, 72000.0],
       ['Spain', 27.0, 48000.0],
       ['Germany', 30.0, 54000.0],
       ['Spain', 38.0, 61000.0],
       ['Germany', 40.0, 63777.77777777778],
       ['France', 35.0, 58000.0],
       ['Spain', 38.77777777777778, 52000.0],
       ['France', 48.0, 79000.0],
       ['Germany', 50.0, 83000.0],
       ['France', 37.0, 67000.0]], dtype=object)
```

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

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

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

```
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)
```

```
from sklearn.preprocessing import StandardScaler
sc=StandardScaler()
sc.fit(final_set)
feat_standard_scaler=sc.transform(final_set)
feat_standard_scaler
```

```
array([[ 1.22474487e+00, -6.54653671e-01, -6.54653671e-01,
         7.58874362e-01,  7.49473254e-01],
       [-8.16496581e-01, -6.54653671e-01,  1.52752523e+00,
        -1.71150388e+00, -1.43817841e+00],
       [-8.16496581e-01,  1.52752523e+00, -6.54653671e-01,
        -1.27555478e+00, -8.91265492e-01],
       [-8.16496581e-01, -6.54653671e-01,  1.52752523e+00,
        -1.13023841e-01, -2.53200424e-01],
       [-8.16496581e-01,  1.52752523e+00, -6.54653671e-01,
         1.77608893e-01,  6.63219199e-16],
       [ 1.22474487e+00, -6.54653671e-01, -6.54653671e-01,
        -5.48972942e-01, -5.26656882e-01],
       [-8.16496581e-01, -6.54653671e-01,  1.52752523e+00,
         0.00000000e+00, -1.07356980e+00],
       [ 1.22474487e+00, -6.54653671e-01, -6.54653671e-01,
         1.34013983e+00,  1.38753832e+00],
       [-8.16496581e-01,  1.52752523e+00, -6.54653671e-01,
         1.63077256e+00,  1.75214693e+00],
       [ 1.22474487e+00, -6.54653671e-01, -6.54653671e-01,
        -2.58340208e-01,  2.93712492e-01]])
```

```
from sklearn.preprocessing import MinMaxScaler
mms=MinMaxScaler(feature_range=(0,1))
mms.fit(final_set)
feat_minmax_scaler=mms.transform(final_set)
feat_minmax_scaler
```

```
array([[1.        , 0.        , 0.        , 0.73913043, 0.68571429],
       [0.        , 0.        , 1.        , 0.        , 0.        ],
       [0.        , 1.        , 0.        , 0.13043478, 0.17142857],
       [0.        , 0.        , 1.        , 0.47826087, 0.37142857],
       [0.        , 1.        , 0.        , 0.56521739, 0.45079365],
       [1.        , 0.        , 0.        , 0.34782609, 0.28571429],
       [0.        , 0.        , 1.        , 0.51207729, 0.11428571],
```

```
       [1.        , 0.        , 0.        , 0.91304348, 0.88571429],
       [0.        , 1.        , 0.        , 1.        , 1.        ],
       [1.        , 0.        , 0.        , 0.43478261, 0.54285714]])
```

```
import numpy as np
array=np.random.randint(1,100,16)
array
```

```
array([78, 82, 16, 15, 41, 27, 40, 37, 52, 83, 69, 93, 98, 90, 94, 33],
      dtype=int32)
```

```
array.mean()
```

```
np.float64(59.25)
```

```
np.percentile(array,25)
```

```
np.float64(36.0)
```

```
np.percentile(array,50)
```

```
np.float64(60.5)
```

```
np.percentile(array,75)
```

```
np.float64(84.75)
```

```
np.percentile(array,100)
```

```
np.float64(98.0)
```

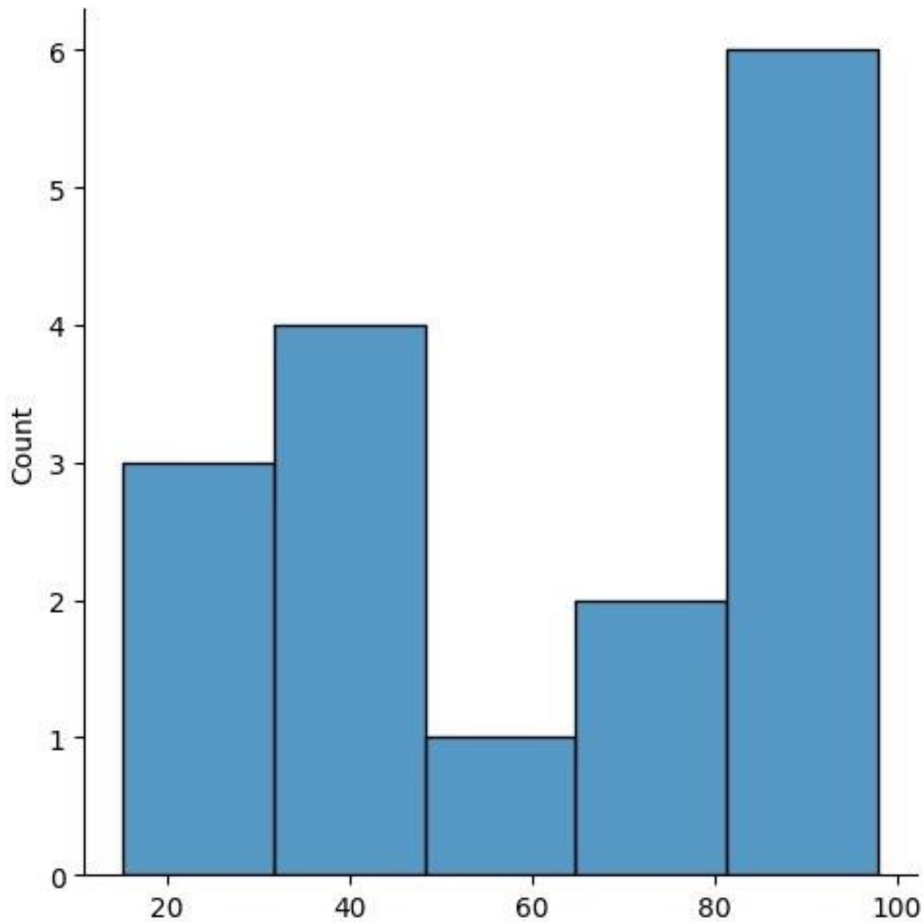
```
def  outDetection(array):
    sorted(array)
    Q1,Q3=np.percentile(array,[25,75])
    IQR=Q3-Q1
    lr=Q1-(1.5*IQR)
    ur=Q3+(1.5*IQR)
    return lr,ur
```

```
lr,ur=outDetection(array)
lr,ur
```

```
(np.float64(-37.125), np.float64(157.875))
```

```
sns.displot(array)
```

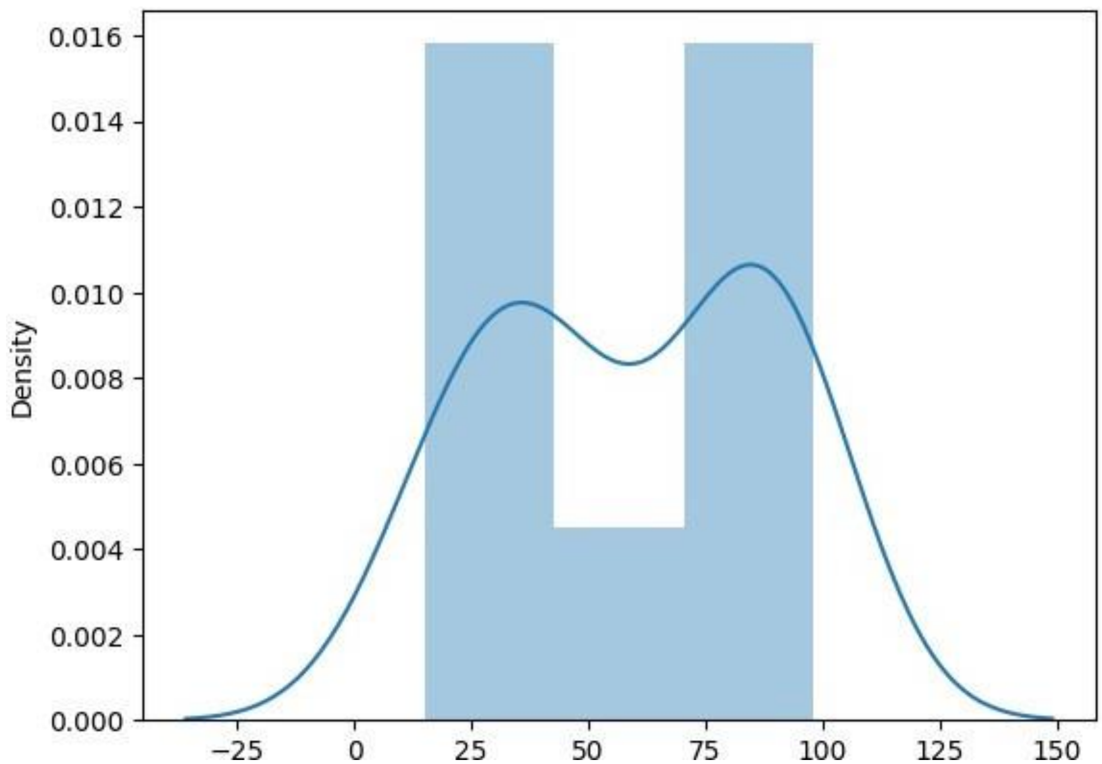
```
<seaborn.axisgrid.FacetGrid at 0x2704bddf7f0>
```




```
sns.distplot(array)
```

```
C:\Users\Dhanush Kumar\AppData\Local\Temp\ipykernel_24196\1133588802.py:1:
UserWarning:

`distplot` is a deprecated function and will be removed in seaborn v0.14.0.

Please adapt your code to use either `displot` (a figure-level function with
similar flexibility) or `histplot` (an axes-level function for histograms).

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

  sns.distplot(array)
```

```
<Axes: ylabel='Density'>
```




```
new_array=array[(array>lr) & (array<ur)]
new_array
```

```
array([78, 82, 16, 15, 41, 27, 40, 37, 52, 83, 69, 93, 98, 90, 94, 33],
      dtype=int32)
```

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

```
(np.float64(-37.125), np.float64(157.875))
```

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

```
array([89,  2, 12, 49, 51, 15, 68, 85, 80, 24, 33, 53, 84, 50, 53,  8])
```

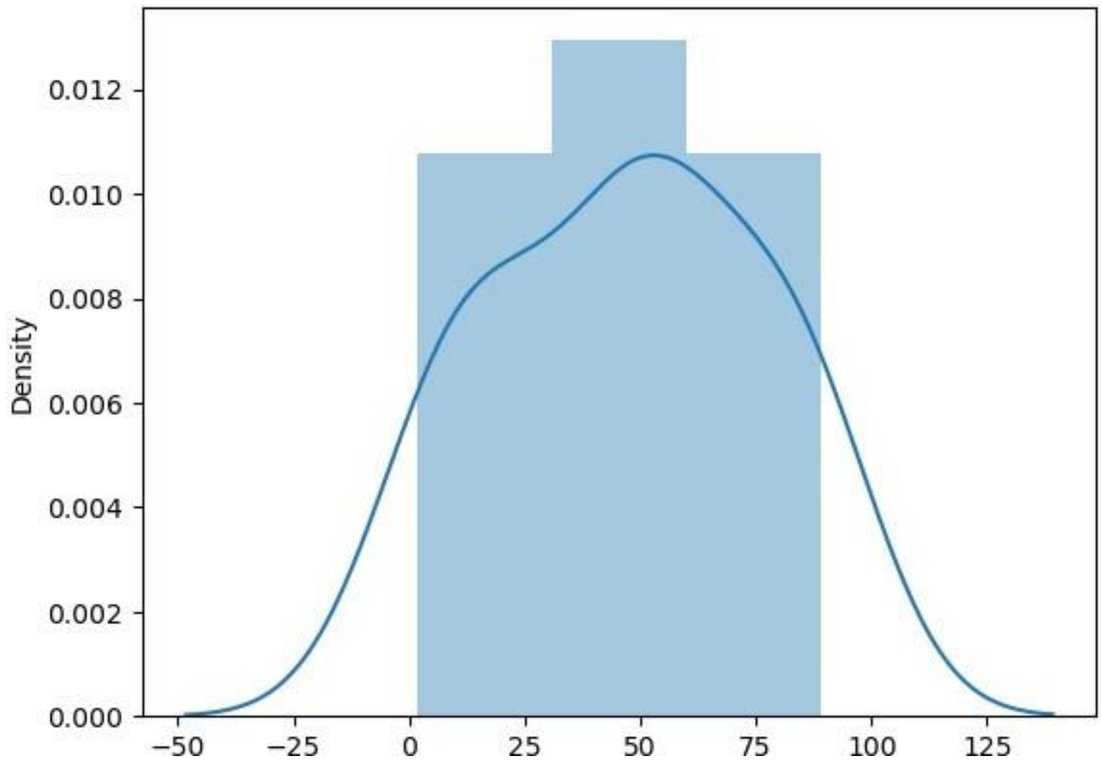
```
sns.distplot(final_array)
```

```
C:\Users\HDC0422095\AppData\Local\Temp\ipykernel_2332\209491988.py:1:
UserWarning:

`distplot` is a deprecated function and will be removed in seaborn v0.14.0.

Please adapt your code to use either `displot` (a figure-level function with
similar flexibility) or `histplot` (an axes-level function for histograms).

For a guide to updating your code to use the new functions, please see
```

https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751

```
sns.distplot(final_array)
```

<Axes: ylabel='Density'>



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()

	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
tips
   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
..         ...   ...     ...    ...   ...     ...   ...
239      29.03  5.92    Male     No   Sat  Dinner     3
240      27.18  2.00  Female    Yes   Sat  Dinner     2
241      22.67  2.00    Male    Yes   Sat  Dinner     2
242      17.82  1.75    Male     No   Sat  Dinner     2
243      18.78  3.00  Female     No  Thur  Dinner     2

[244 rows x 7 columns]
sns.displot(tips.total_bill,kde=True)
<seaborn.axisgrid.FacetGrid at 0x1ab9bf48a60>

sns.displot(tips.total_bill,kde=False)
<seaborn.axisgrid.FacetGrid at 0x294ad6d7d10>

sns.jointplot(x=tips.tip,y=tips.total_bill)
<seaborn.axisgrid.JointGrid at 0x294ad778a70>
```

```
sns.jointplot(x=tips.tip,y=tips.total_bill,kind="reg")
<seaborn.axisgrid.JointGrid at 0x294a8ba4740>
```

```
sns.jointplot(x=tips.tip,y=tips.total_bill,kind="hex")
<seaborn.axisgrid.JointGrid at 0x294ade95220>
```

```
sns.pairplot(tips)
<seaborn.axisgrid.PairGrid at 0x294a8c7aa20>
```

```
tips.time.value_counts()
time
Dinner    176
Lunch      68
Name: count, dtype: int64
sns.pairplot(tips,hue='time')
<seaborn.axisgrid.PairGrid at 0x294aed013a0>
```

```
sns.pairplot(tips,hue='day')
<seaborn.axisgrid.PairGrid at 0x294aecf56a0>
```

```
sns.heatmap(tips.corr(numeric_only=True),annot=True)
<Axes: >
```

```
sns.boxplot(tips.total_bill)
<Axes: ylabel='total_bill'>
```

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

<Axes: ylabel='tip'>

sns.countplot(tips.day)

<Axes: xlabel='count', ylabel='day'>

sns.countplot(tips.sex)

<Axes: xlabel='count', ylabel='sex'>

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

<Axes: ylabel='count'>

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

<Axes: xlabel='sex'>

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

<Axes: xlabel='count', ylabel='day'>

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

```
    YearsExperience  Salary
0               1.1   39343
1               1.3   46205
2               1.5   37731
3               2.0   43525
4               2.2   39891
5               2.9   56642
6               3.0   60150
7               3.2   54445
8               3.2   64445
9               3.7   57189
10              3.9   63218
11              4.0   55794
```

```
12               4.0   56957
13               4.1   57081
14               4.5   61111
15               4.9   67938
16               5.1   66029
17               5.3   83088
18               5.9   81363
19               6.0   93940
20               6.8   91738
21               7.1   98273
22               7.9  101302
23               8.2  113812
24               8.7  109431
25               9.0  105582
26               9.5  116969
27               9.6  112635
28              10.3  122391
29              10.5  121872
```

```
df.info()
```

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

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

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

```
df.describe()
```

```
       YearsExperience        Salary
count        30.000000     30.000000
mean          5.313333  76003.000000
std           2.837888  27414.429785
min           1.100000  37731.000000
```

```
25%           3.200000   56720.750000
50%           4.700000   65237.000000
75%           7.700000  100544.750000
max          10.500000  122391.000000
```

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

```
from sklearn.model_selection import train_test_split
x_train,x_test,y_train,y_test=train_test_split(features,label,test_size=0.2,r
andom_state=23)
```

```
from sklearn.linear_model import LinearRegression
model=LinearRegression()
model.fit(x_train,y_train)
```

```
LinearRegression()
```

```
print(x_train.shape)
print(y_train.shape)
```

```
(24, 1)
(24, 1)
```

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

```
0.9603182547438908
```

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

```
0.9184170849214232
```

```
model.coef_
```

```
array([[9281.30847068]])
```

```
model.intercept_
```

```
array([27166.73682891])
```

```
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[0]))
```

```
Enter Years of Experience:  41
```

```
Estimated Salary for 41.0 years of experience is: [407700.38412682]
```

```python
import numpy as np
import pandas as pd
df=pd.read_csv('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]
```

```python
df.head()
```

```
    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
```

```python
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],
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```

```
label
```

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```

```
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       1, 1, 0, 1])
```

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

for i in range(1,401):

x_train,x_test,y_train,y_test=train_test_split(features,label,test_size=0.5,r
andom_state=i)
    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 0.845 Train0.84 Random State 3
Test 0.855 Train0.83 Random State 5
Test 0.855 Train0.805 Random State 6
Test 0.865 Train0.815 Random State 7
Test 0.85 Train0.835 Random State 8
Test 0.855 Train0.83 Random State 10
Test 0.84 Train0.835 Random State 13
Test 0.87 Train0.865 Random State 15
Test 0.875 Train0.845 Random State 17
Test 0.87 Train0.835 Random State 18
Test 0.825 Train0.82 Random State 20
Test 0.855 Train0.82 Random State 21
Test 0.865 Train0.84 Random State 22
Test 0.87 Train0.825 Random State 27
Test 0.85 Train0.84 Random State 29
Test 0.85 Train0.835 Random State 37
Test 0.85 Train0.835 Random State 42
Test 0.895 Train0.825 Random State 46
Test 0.85 Train0.815 Random State 47
Test 0.855 Train0.835 Random State 48
Test 0.86 Train0.845 Random State 51
Test 0.845 Train0.84 Random State 52
Test 0.87 Train0.81 Random State 54
Test 0.855 Train0.795 Random State 56
```

```
Test 0.85 Train0.84 Random State 59
Test 0.875 Train0.855 Random State 61
Test 0.875 Train0.855 Random State 64
Test 0.855 Train0.825 Random State 65
Test 0.87 Train0.815 Random State 68
Test 0.835 Train0.83 Random State 72
Test 0.835 Train0.82 Random State 73
Test 0.875 Train0.84 Random State 74
Test 0.875 Train0.85 Random State 75
Test 0.865 Train0.84 Random State 76
Test 0.855 Train0.83 Random State 77
Test 0.855 Train0.825 Random State 79
Test 0.86 Train0.825 Random State 82
Test 0.865 Train0.835 Random State 84
Test 0.88 Train0.83 Random State 85
Test 0.855 Train0.835 Random State 86
Test 0.87 Train0.815 Random State 88
Test 0.905 Train0.805 Random State 90
Test 0.845 Train0.84 Random State 91
Test 0.87 Train0.84 Random State 95
Test 0.86 Train0.84 Random State 98
Test 0.87 Train0.845 Random State 99
Test 0.85 Train0.84 Random State 100
Test 0.87 Train0.845 Random State 104
Test 0.855 Train0.835 Random State 105
Test 0.865 Train0.83 Random State 106
Test 0.86 Train0.83 Random State 109
Test 0.87 Train0.815 Random State 112
Test 0.855 Train0.825 Random State 115
Test 0.86 Train0.84 Random State 116
Test 0.85 Train0.84 Random State 119
Test 0.88 Train0.83 Random State 120
Test 0.85 Train0.835 Random State 123
Test 0.865 Train0.85 Random State 125
Test 0.855 Train0.845 Random State 127
Test 0.865 Train0.85 Random State 128
Test 0.87 Train0.85 Random State 130
Test 0.865 Train0.825 Random State 133
Test 0.855 Train0.84 Random State 134
Test 0.87 Train0.85 Random State 136
Test 0.85 Train0.825 Random State 141
Test 0.845 Train0.83 Random State 143
Test 0.835 Train0.83 Random State 146
Test 0.85 Train0.845 Random State 147
Test 0.86 Train0.83 Random State 148
Test 0.88 Train0.825 Random State 150
Test 0.895 Train0.835 Random State 152
Test 0.86 Train0.855 Random State 154
Test 0.86 Train0.82 Random State 155
Test 0.87 Train0.86 Random State 156
```

```
Test 0.86 Train0.85 Random State 159
Test 0.865 Train0.845 Random State 162
Test 0.85 Train0.8 Random State 163
Test 0.87 Train0.835 Random State 164
Test 0.845 Train0.84 Random State 173
Test 0.855 Train0.845 Random State 174
Test 0.86 Train0.83 Random State 178
Test 0.86 Train0.84 Random State 179
Test 0.86 Train0.825 Random State 180
Test 0.875 Train0.84 Random State 184
Test 0.845 Train0.84 Random State 185
Test 0.86 Train0.85 Random State 186
Test 0.875 Train0.825 Random State 187
Test 0.84 Train0.835 Random State 189
Test 0.86 Train0.84 Random State 192
Test 0.845 Train0.83 Random State 194
Test 0.835 Train0.81 Random State 196
Test 0.85 Train0.835 Random State 200
Test 0.88 Train0.805 Random State 202
Test 0.885 Train0.835 Random State 203
Test 0.865 Train0.845 Random State 206
Test 0.86 Train0.82 Random State 209
Test 0.855 Train0.83 Random State 211
Test 0.855 Train0.835 Random State 212
Test 0.89 Train0.83 Random State 213
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Test 0.895 Train0.82 Random State 220
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Test 0.86 Train0.85 Random State 229
Test 0.865 Train0.84 Random State 232
Test 0.845 Train0.84 Random State 235
Test 0.855 Train0.825 Random State 242
Test 0.84 Train0.835 Random State 243
Test 0.87 Train0.835 Random State 245
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Test 0.855 Train0.85 Random State 254
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Test 0.855 Train0.835 Random State 268
Test 0.85 Train0.83 Random State 269
Test 0.885 Train0.82 Random State 270
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Test 0.875 Train0.815 Random State 285
Test 0.87 Train0.835 Random State 287
Test 0.855 Train0.835 Random State 289
Test 0.87 Train0.815 Random State 290
```

```
Test 0.83 Train0.82 Random State 296
Test 0.855 Train0.825 Random State 297
Test 0.855 Train0.85 Random State 302
Test 0.855 Train0.85 Random State 303
Test 0.865 Train0.845 Random State 304
Test 0.885 Train0.835 Random State 306
Test 0.89 Train0.84 Random State 308
Test 0.87 Train0.835 Random State 314
Test 0.875 Train0.845 Random State 317
Test 0.855 Train0.85 Random State 318
Test 0.86 Train0.83 Random State 319
Test 0.86 Train0.83 Random State 321
Test 0.855 Train0.85 Random State 326
Test 0.835 Train0.825 Random State 331
Test 0.84 Train0.825 Random State 334
Test 0.865 Train0.835 Random State 336
Test 0.865 Train0.81 Random State 337
Test 0.875 Train0.81 Random State 339
Test 0.865 Train0.86 Random State 344
Test 0.875 Train0.855 Random State 347
Test 0.87 Train0.85 Random State 351
Test 0.865 Train0.82 Random State 354
Test 0.87 Train0.82 Random State 358
Test 0.865 Train0.855 Random State 361
Test 0.87 Train0.84 Random State 362
Test 0.89 Train0.83 Random State 363
Test 0.865 Train0.86 Random State 364
Test 0.86 Train0.835 Random State 366
Test 0.875 Train0.825 Random State 369
Test 0.865 Train0.845 Random State 370
Test 0.87 Train0.855 Random State 371
Test 0.865 Train0.815 Random State 376
Test 0.885 Train0.83 Random State 378
Test 0.865 Train0.85 Random State 379
Test 0.865 Train0.825 Random State 383
Test 0.865 Train0.84 Random State 386
Test 0.865 Train0.855 Random State 390
Test 0.875 Train0.835 Random State 393
Test 0.855 Train0.83 Random State 394
Test 0.89 Train0.84 Random State 399
```

```
x_train,x_test,y_train,y_test=train_test_split(features,label,test_size=0.2,r
andom_state=3)
finalModel=LogisticRegression()
finalModel.fit(x_train,y_train)
```

```
LogisticRegression()
```

```
print(finalModel.score(x_train,y_train))
print(finalModel.score(x_test,y_test))
```

```
0.85625
0.8375
```

```
from sklearn.metrics import classification_report
print(classification_report(label,finalModel.predict(features)))
```

```
              precision    recall  f1-score   support

           0       0.86      0.91      0.89       257
           1       0.83      0.74      0.78       143

    accuracy                           0.85       400
   macro avg       0.85      0.83      0.84       400
weighted avg       0.85      0.85      0.85       400
```

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

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

```
     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
..          ...     ...  ...                 ...                     ...
195         196  Female   35                 120                      79
196         197  Female   45                 126                      28
197         198    Male   32                 126                      74
198         199    Male   32                 137                      18
199         200    Male   30                 137                      83

[200 rows x 5 columns]
```

```
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
```

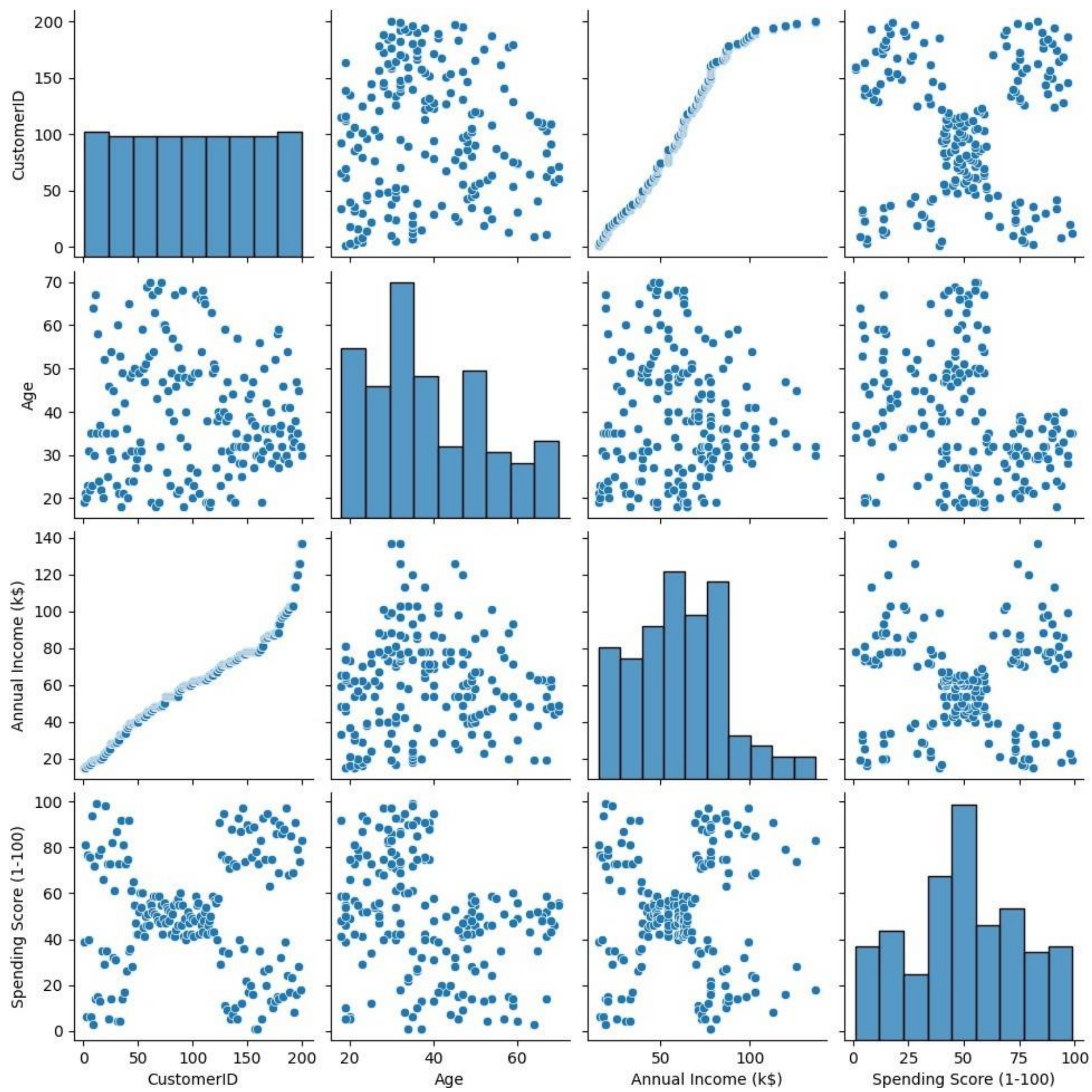
```
 2   Age                     200 non-null    int64
 3   Annual Income (k$)      200 non-null    int64
 4   Spending Score (1-100)  200 non-null    int64
dtypes: int64(4), object(1)
memory usage: 7.9+ KB
```

```
df.head()
```

```
   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
```

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

```
<seaborn.axisgrid.PairGrid at 0x179eb0db0a0>
```




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

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

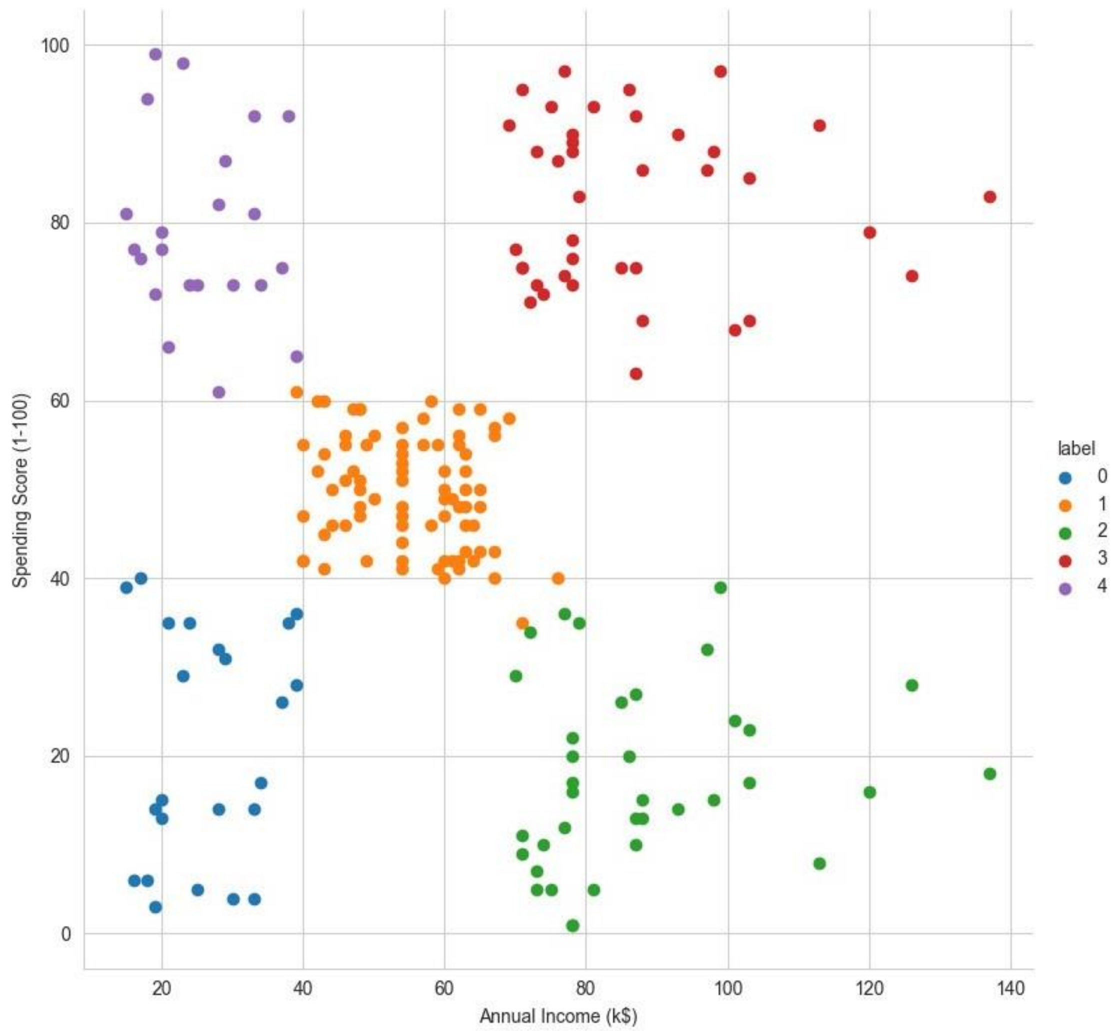
```
KMeans(n_clusters=5)
```

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

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

3	16	77	4
4	17	40	0

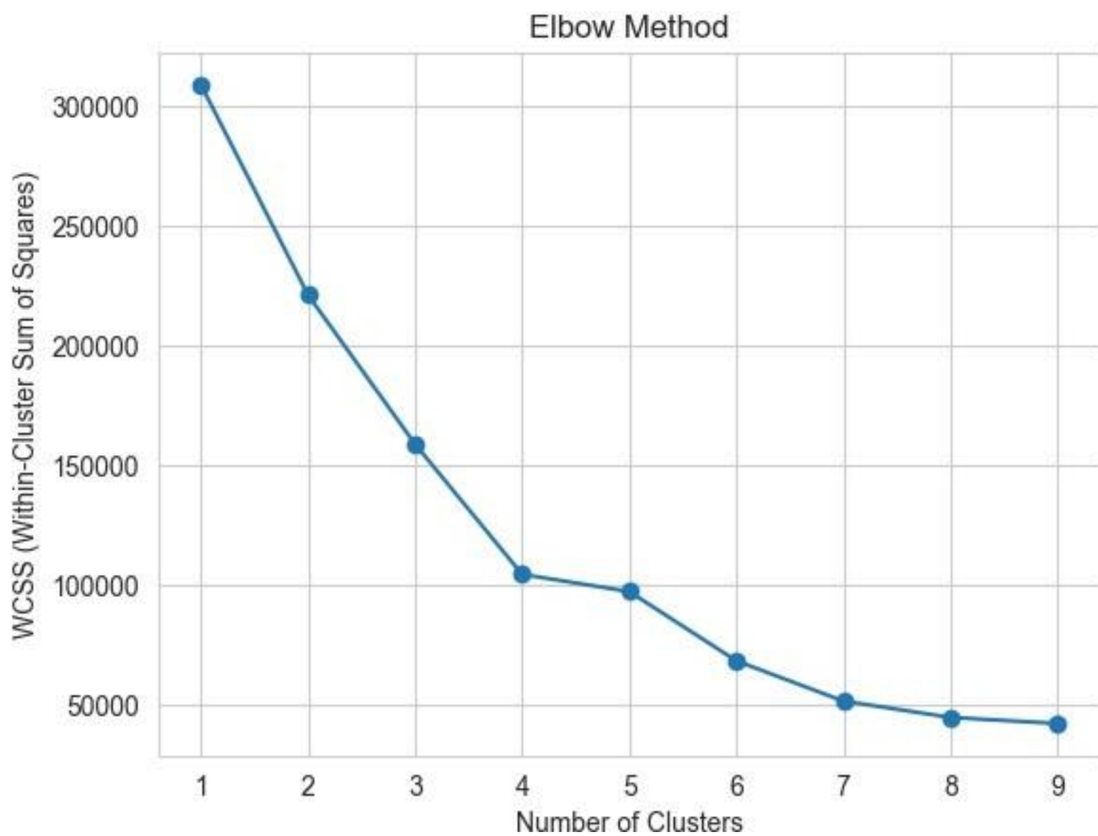
```
sns.set_style("whitegrid")
sns.FacetGrid(Final,hue="label",height=8) \
.map(plt.scatter,"Annual Income (k$)", "Spending Score (1-100)") \
.add_legend();
plt.show()
```




```
features_el=df.iloc[:,[2,3,4]].values
from sklearn.cluster import KMeans
wcss = []
for i in range(1, 10):
    model = KMeans(n_clusters=i, random_state=42)
    model.fit(features_el)
    wcss.append(model.inertia_)

plt.plot(range(1, 10), wcss, marker='o')
plt.title("Elbow Method")
```

```
plt.xlabel("Number of Clusters")
plt.ylabel("WCSS (Within-Cluster Sum of Squares)")
plt.show()
```




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

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 150 entries, 0 to 149
Data columns (total 5 columns):
 #   Column        Non-Null Count  Dtype
---  ------        --------------  -----
 0   sepal.length  150 non-null    float64
 1   sepal.width   150 non-null    float64
 2   petal.length  150 non-null    float64
 3   petal.width   150 non-null    float64
 4   variety       150 non-null    object
dtypes: float64(4), object(1)
memory usage: 6.0+ KB
```

```
df.variety.value_counts()
```

```
variety
Setosa        50
Versicolor    50
Virginica     50
Name: count, dtype: int64
```

```
df.head()
```

```
   sepal.length  sepal.width  petal.length  petal.width variety
0           5.1          3.5           1.4          0.2  Setosa
1           4.9          3.0           1.4          0.2  Setosa
2           4.7          3.2           1.3          0.2  Setosa
3           4.6          3.1           1.5          0.2  Setosa
4           5.0          3.6           1.4          0.2  Setosa
```

```
features=df.iloc[:,:-1].values
label=df.iloc[:,4].values
```

```
from sklearn.model_selection import train_test_split
from sklearn.neighbors import KNeighborsClassifier
```

```
xtrain,xtest,ytrain,ytest=train_test_split(features,label,test_size=.2,random
_state=3)
model_KNN=KNeighborsClassifier(n_neighbors=5)
model_KNN.fit(xtrain,ytrain)
```

```
KNeighborsClassifier()
```

```
print(model_KNN.score(xtrain,ytrain))
print(model_KNN.score(xtest,ytest))
```

```
0.9666666666666667
0.9666666666666667
```

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

```
array([[50,  0,  0],
       [ 0, 46,  4],
       [ 0,  1, 49]], dtype=int64)
```

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

```
              precision    recall  f1-score   support

      Setosa       1.00      1.00      1.00        50
  Versicolor       0.98      0.92      0.95        50
   Virginica       0.92      0.98      0.95        50

    accuracy                           0.97       150
   macro avg       0.97      0.97      0.97       150
```

```
weighted avg       0.97      0.97      0.97       150
```

```
#T-Test

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"T-statistic: {t_stat:.3f}")
print(f"P-value: {p_value:.4f}")
alpha = 0.05
if p_value < alpha:
    print("Reject Null Hypothesis → Mean is significantly different from 
70.")
else:
    print("Fail to Reject Null Hypothesis → No significant difference.")
```

```
T-statistic: 1.993
P-value: 0.0774
Fail to Reject Null Hypothesis → No significant difference.
```

```
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("Z-statistic: {z_stat:.3f}")
print("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")
```

```
Z-statistic: {z_stat:.3f}
P-value: {p_value:.4f}
Reject Null Hypothesis → Mean is significantly different from 50 g.
```

```python
#Anova test

import numpy as np
from scipy import stats


A = [20, 22, 23]
B = [19, 20, 18]
C = [25, 27, 26]


f_stat, p_value = stats.f_oneway(A, B, C)

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

alpha = 0.05
if p_value < alpha:
    print("Reject Null Hypothesis → Means are significantly different.")
else:
    print("Fail to Reject Null Hypothesis → No significant difference.")
```

```
F-statistic: 25.923
P-value: 0.0011
Reject Null Hypothesis → Means are significantly different.
```