1.SEABORN

[ ]:
```
#EX NO:1A
#BASIC PRACTICE EXPERIMENTS 30/07/2024
#ARITRA GUPTA
#230701033
#CSE A
```

[318]:
```
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
%matplotlib inline
```

[322]:
```
data=pd.read_csv('Iris - Iris.csv')
data
```

[322]:

	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
..	…	…	…	…	…
145	6.7	3.0	5.2	2.3	Virginica
146	6.3	2.5	5.0	1.9	Virginica
147	6.5	3.0	5.2	2.0	Virginica
148	6.2	3.4	5.4	2.3	Virginica
149	5.9	3.0	5.1	1.8	Virginica

[150 rows x 5 columns]

[324]:
```
data.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
```

[326]:
```
data.describe()
```

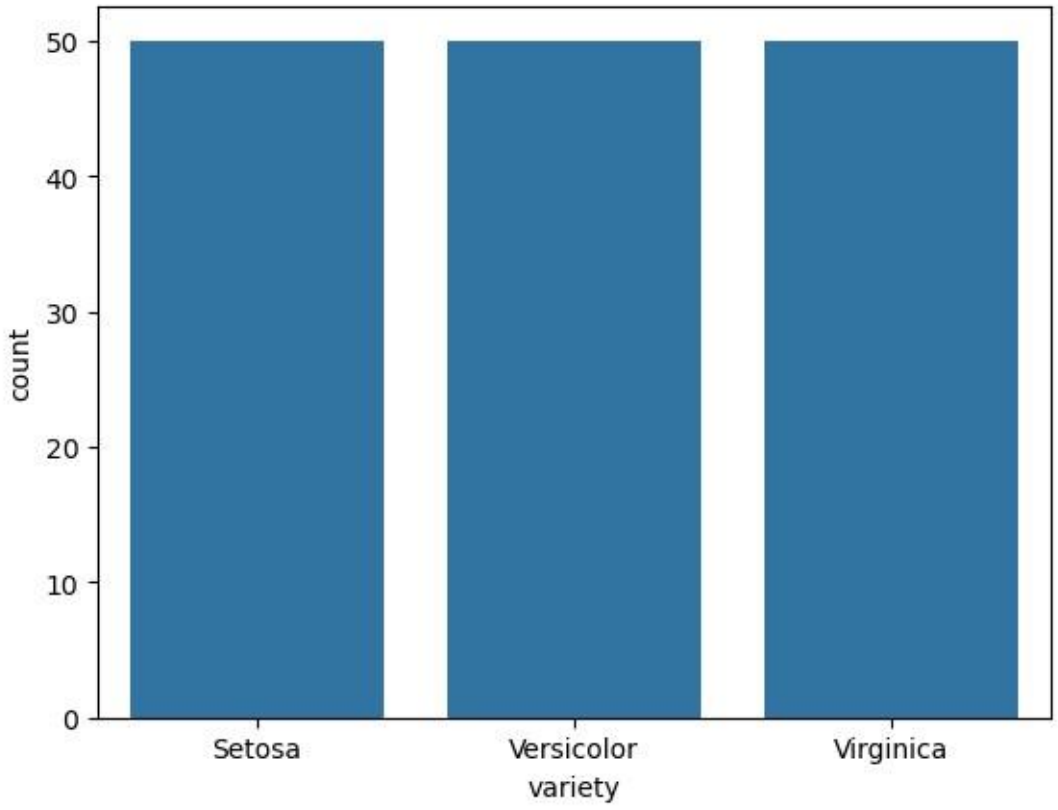
[326]:

	sepal.length	sepal.width	petal.length	petal.width
count	150.000000	150.000000	150.000000	150.000000
mean	5.843333	3.057333	3.758000	1.199333
std	0.828066	0.435866	1.765298	0.762238
min	4.300000	2.000000	1.000000	0.100000
25%	5.100000	2.800000	1.600000	0.300000
50%	5.800000	3.000000	4.350000	1.300000
75%	6.400000	3.300000	5.100000	1.800000
max	7.900000	4.400000	6.900000	2.500000

[328]:
```
data.value_counts('variety')
```

[328]:
```
variety

Setosa       50

Versicolor   50

Virginica    50

 Name: count, dtype: int64
```

[330]:
```
sns.countplot(x='variety',data=data,)
plt.show()
```



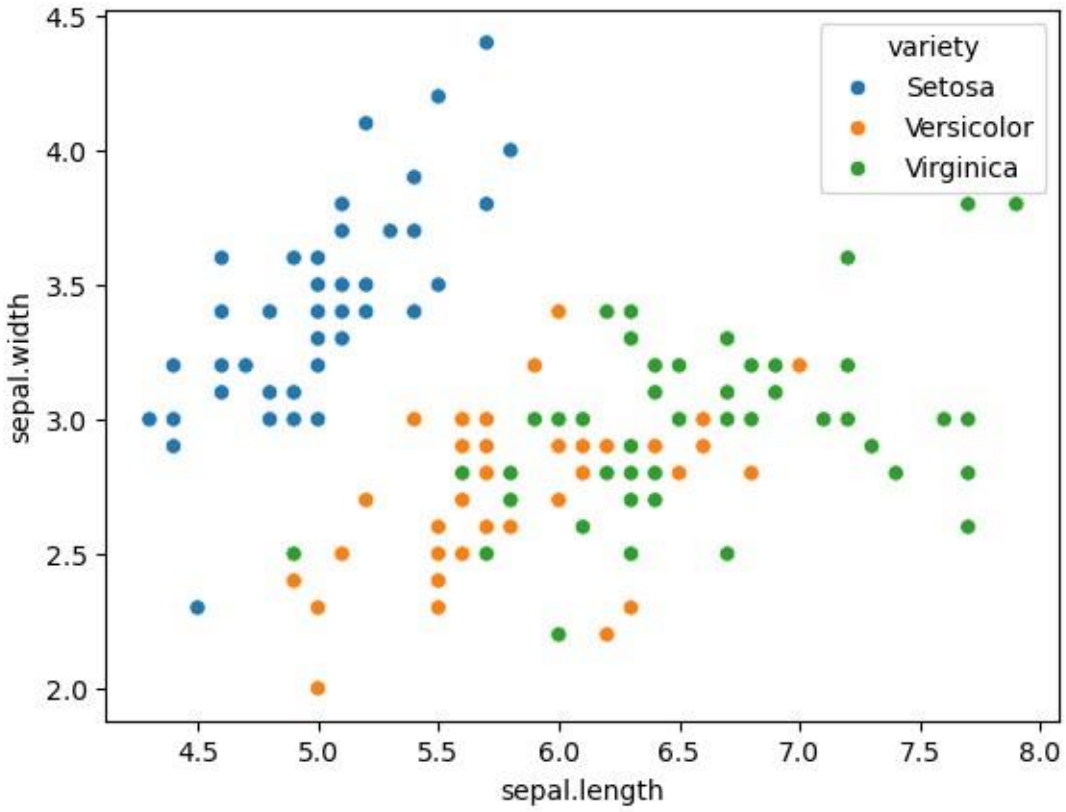

```
[332]: dummies=pd.get_dummies(data.variety)
       FinalDataset=pd.concat([pd.get_dummies(data.variety),da
       ta.iloc[: ↪,[0,1,2,3]]],axis=1) FinalDataset.head()
```

[332]:

	Setosa	Versicolor	Virginica	sepal.length	sepal.width	petal.length
0	True	False	False	5.1	3.5	1.4
1	True	False	False	4.9	3.0	1.4
2	True	False	False	4.7	3.2	1.3
3	True	False	False	4.6	3.1	1.5
4	True	False	False	5.0	3.6	1.4

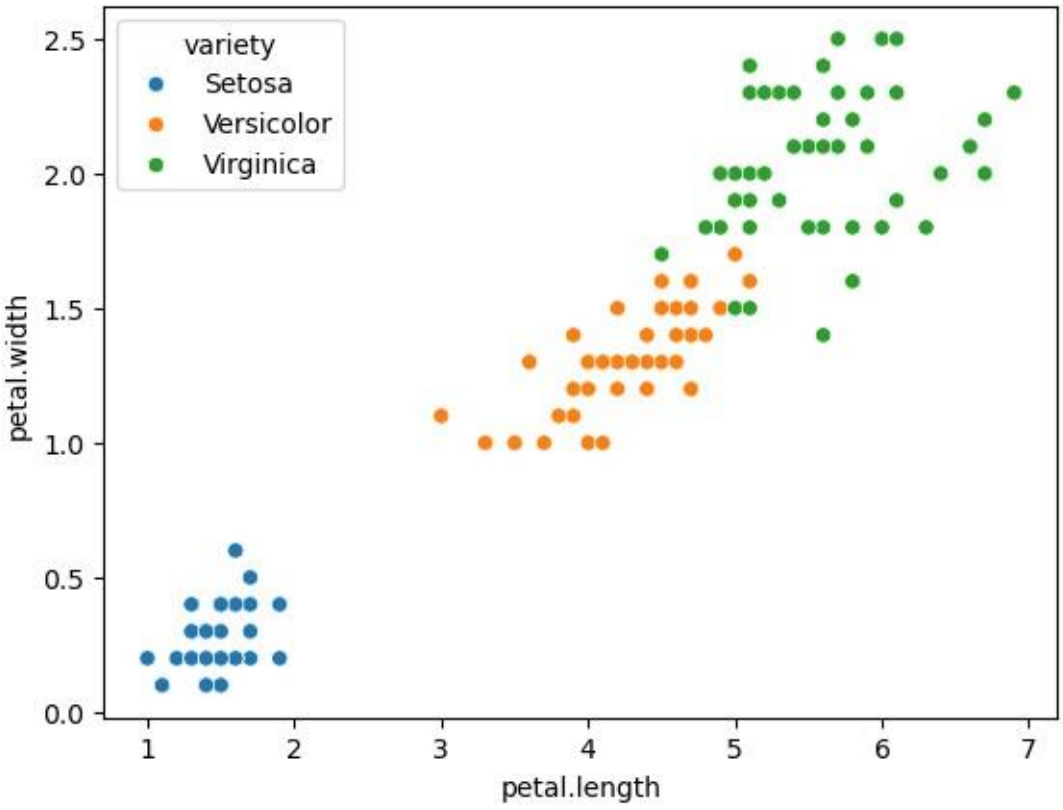
4 0 2

[340]:
```
sns.scatterplot(x='sepal.length',y='sepal.width',hue='variety',data=data
)
```
[340]: <Axes: xlabel='sepal.length', ylabel='sepal.width'>

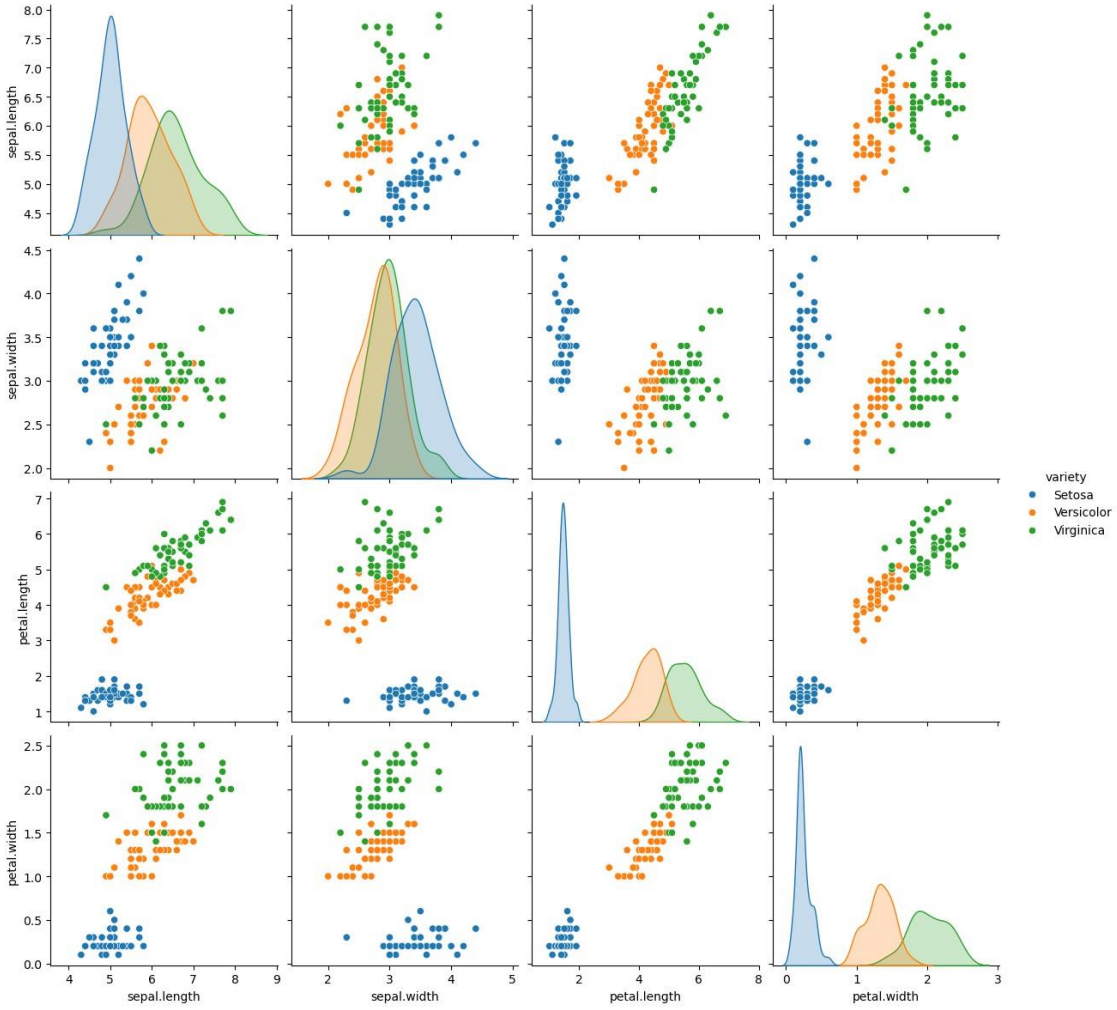


[342]:
```
sns.scatterplot(x='petal.length',y='petal.width',hue='variety',data=data
,)
```

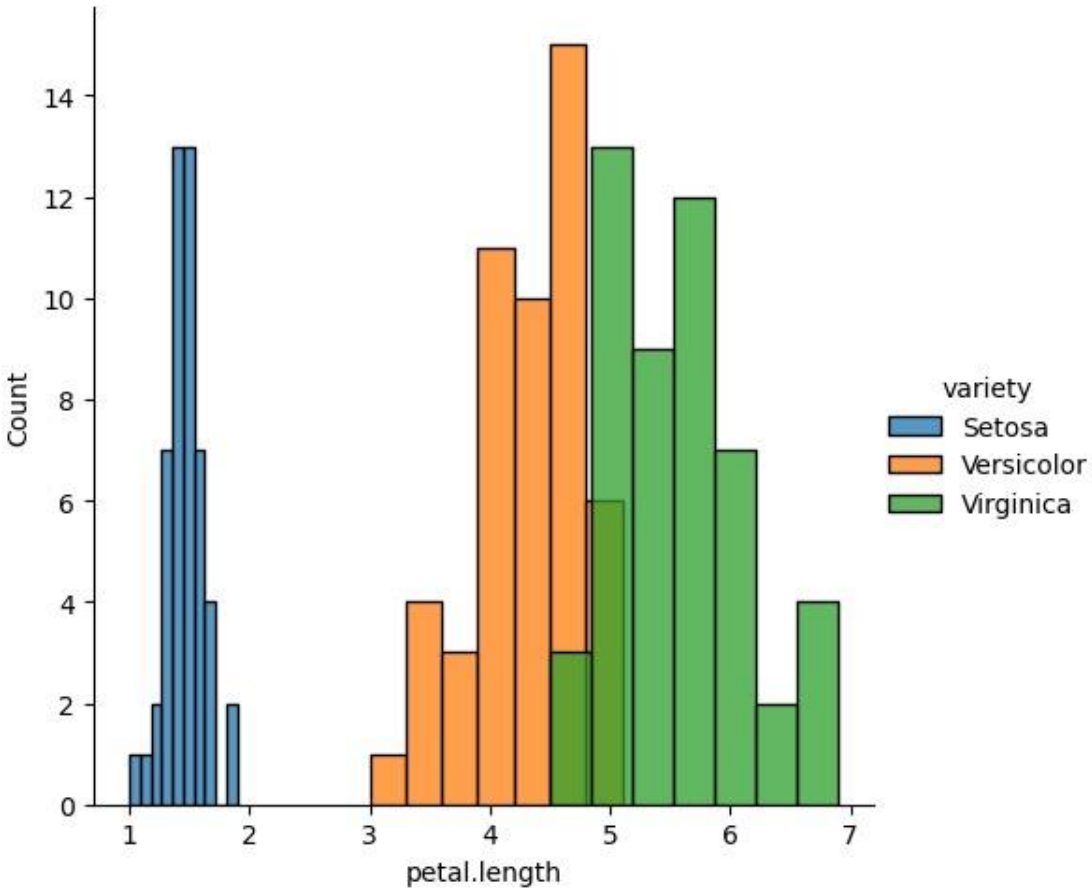
[342]: <Axes: xlabel='petal.length', ylabel='petal.width'>



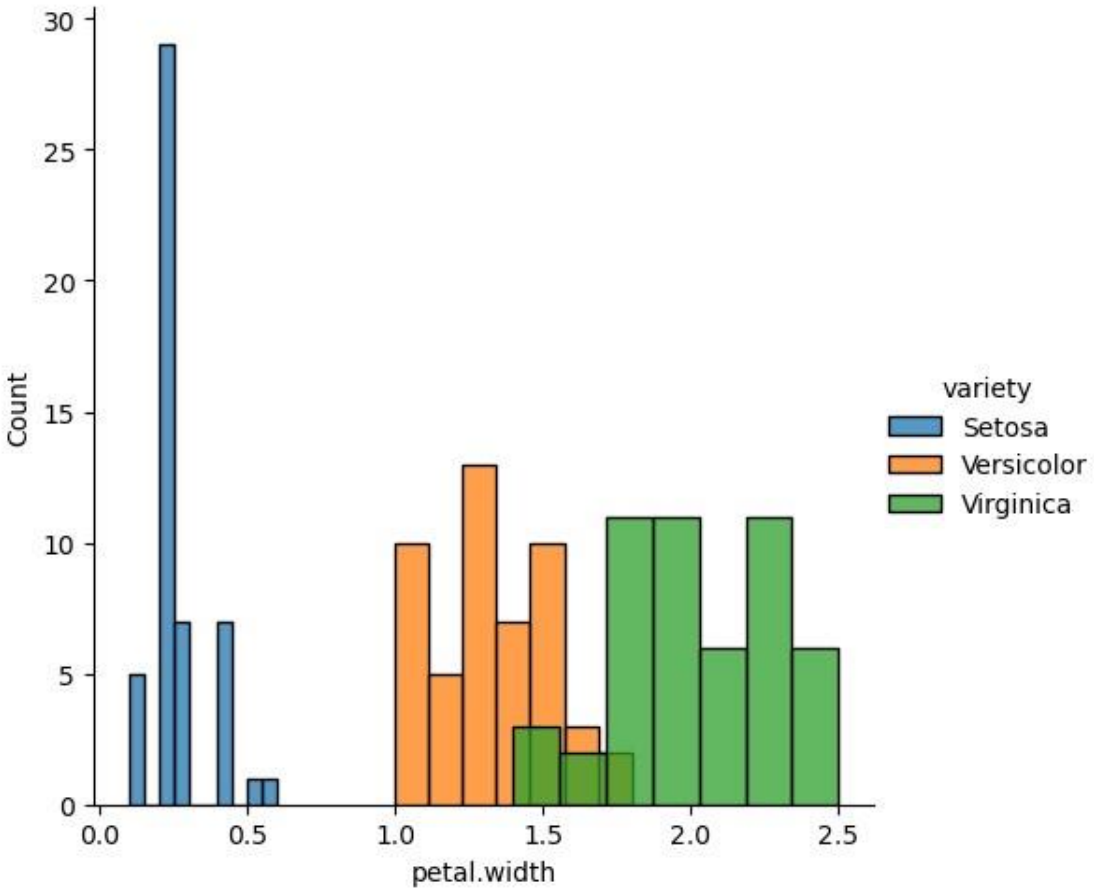
[345]:
```
sns.pairplot(data,hue='variety',height=3);
```



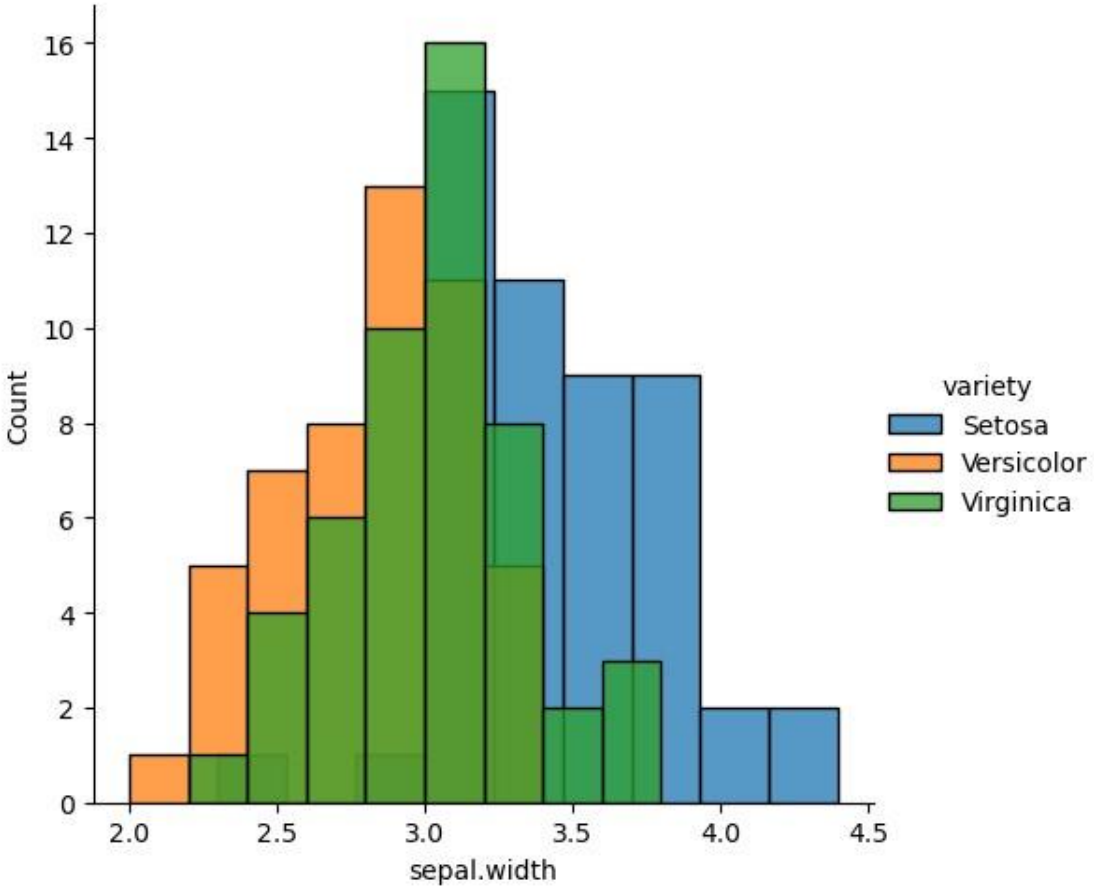
[351]:
```
sns.FacetGrid(data,hue='variety',height=5).map(sns.histplot,'petal.length').
  ↪add_legend();
plt.show();
```



[353]:
```
sns.FacetGrid(data,hue='variety',height=5).map(sns.histplot,'petal.width').
  ↪add_legend();
plt.show();
```



[355]:
```
sns.FacetGrid(data,hue='variety',height=5).map(sns.histplot,'sepal.width').
  ↪add_legend();
plt.show();
```


16
14
12
10
8
6
4
2
0
Count
2.0
2.5
3.0
3.5
4.0
4.5
sepal.width
variety
Setosa
Versicolor
Virginica

[ ]:

2.NUMPY

[ ]:
```
#EX NO:1B
#NUMPY 06/08/2024
#ARITRA GUPTA
#230701033
#CSE A
```

[7]:
```
import numpy as np
array=np.random.randint(1,100,9)
array
```

[7]:
```
array([38, 13, 41, 2, 67, 22, 22, 79, 62])
```

[9]:
```
np.sqrt(array)
```

[9]:
```
array([6.164414 , 3.60555128, 6.40312424, 1.41421356,
8.18535277,
       4.69041576, 4.69041576, 8.88819442, 7.87400787])
```

[11]:
```
array.ndim //number of dimension
```

[11]:
```
1
```

[15]:
```
new_array=array.reshape(3,3) //changes 1d to 2d
new_array
```

[15]:
```
array([[38, 13,
        41], [ 2,
        67, 22],
        [22, 79, 62]])
```

[17]:
```
new_array.ndim
```

[17]:
```
2
```

[19]:
```
new_array.ravel() //flattens 2d into 1d
```

[19]:
```
array([38, 13, 41, 2, 67, 22, 22, 79, 62])
```

[25]:
```
newm=new_array.reshape(3,3)
newm
```


[25]:
```
array([[38, 13,
        41], [ 2,
        67, 22],
        [22, 79, 62]])
```

[27]:
```
newm[2,1:3]
```

[27]:
```
array([79, 62])
```

[29]:
```
newm[1:2,1:3]
```

[29]:
```
array([[67, 22]])
```

[31]:
```
new_array[0:3,0:0]
```

[31]:
```
array([], shape=(3, 0), dtype=int32)
```

[33]:
```
new_array[0:2,0:1]
```

[33]:
```
array([[38],
       [ 2]])
```

[35]:
```
new_array[0:3,0:1]
```

[35]:
```
array
([[38
], [
2],
[22]])
```

[37]:
```
new_array[1:3]
```

[37]:
```
array([[ 2, 67, 22],
       [22, 79, 62]])
```

[ ]:
```

```

3.PANDAS

[ ]:
```
#EX NO:4
#PANDAS 06/08/2024
#ARITRA GUPTA
#230701033
#CSE A
```

import numpy as np import pandas as pd list=[[1,'Smith',50000],[2,'Jones',60000]]

[3]:
```
df=pd.DataFrame(list)
df
```

[3]:
```
   0      1      2
0  1  Smith  50000
1  2  Jones  60000
```

[5]:
```
df.columns=['Empd','Name','Salary']
df
```

[5]:
```
Empd Name Salary 0
1 Smith    50000
1    2 Jones   60000
```

[7]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 2 entries, 0 to
1 Data columns (total 3
columns):
 #  Column Non-Null Count Dtype
--- ------ -------------- -----
 0    Empd  2 non-null int64
 1    Name  2 non-null object
 2    Salary 2 non-null     int64 dtypes: int64(2), object(1)
memory usage: 180.0+ bytes
```

[13]:
```
df=pd.read_csv("3_50_Startups.csv")
df.head()
```

[13]:
```
 R&D Spend Administration Marketing Spend State Profit 0
165349.20 136897.80 471784.10 New York 192261.83
1  162597.70     151377.59  443898.53 California 191792.06
2  153441.51     101145.55  407934.54  Florida 191050.39
3  144372.41     118671.85  383199.62  New York 182901.99
4  142107.34     91391.77   366168.42  Florida 166187.94
```

[15]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 50 entries, 0 to
49 Data columns (total 5
columns):
 #   Column          Non-Null Count Dtype
--- ------          -------------- -----
0   R&D Spend       50 non-null    float64
1   Administration  50 non-null    float64
2   Marketing Spend 50 non-null    float64
3    State          50 non-null    object
4    Profit         50 non-null    float64
dtypes: float64(4), object(1)
memory usage: 2.1+ KB
```

[17]:
```
df.tail()
```

[17]:
```
 R&D Spend Administration Marketing Spend State Profit 45
1000.23  124153.04  1903.93  New  York  64926.08  46  1315.46
115816.21 297114.46 Florida 49490.75
47      0.00     135426.92  0.00 California 42559.73
48      542.05 51743.15 0.00 New York 35673.41 49 0.00
        116983.80 45173.06 California 14681.40
```

[25]:
```
df.Profit
```

[25]:
```
0   192261.83
1    191792.06
2    191050.39
3    182901.99
4    166187.94
5    156991.12
6    156122.51
7    155752.60
8    152211.77
9    149759.96
10   146121.95
11   144259.40
12   141585.52
13   134307.35
14   132602.65
 15    129917.04
 16    126992.93
 17    125370.37
 18    124266.90
 19    122776.86
```

```
20    118474.03
21    111313.02
22    110352.25
23    108733.99
24    108552.04
25    107404.34
26    105733.54
27    105008.31
28    103282.38
29    101004.64
30    99937.59
31    97483.56
32    97427.84
33    96778.92
34    96712.80
35    96479.51
36    90708.19
37    89949.14
38    81229.06
39    81005.76
40    78239.91
41    77798.83
42    71498.49
43    69758.98
44    65200.33
45    64926.08
46    49490.75
47    42559.73
48    35673.41
49    14681.40
Name: Profit, dtype: float64
```

[27]:
```
type(df.Profit)
```

[27]:
```
pandas.core.series.Series
```

[29]:
```
df.Profit.mean()
```

[29]:
```
112012.63920000002
```

[31]:
```
df.Profit.median()
```

[31]:
```
107978.19
```

[33]:
```
df.Profit.mode()
```

[33]:
```
0    14681.40
1    35673.41
2    42559.73
```

3	49490.75
4	64926.08
5	65200.33
6	69758.98
7	71498.49
8	77798.83
9	78239.91
10	81005.76
11	81229.06
12	89949.14
13	90708.19
14	96479.51
15	96712.80
16	96778.92
17	97427.84
18	97483.56
19	99937.59
20	101004.64
21	103282.38
22	105008.31
23	105733.54
24	107404.34
25	108552.04
26	108733.99
27	110352.25
28	111313.02
29	118474.03
30	122776.86
31	124266.90
32	125370.37
33	126992.93
34	129917.04
35	132602.65
36	134307.35
37	141585.52
38	144259.40
39	146121.95
40	149759.96
41	152211.77
42	155752.60
43	156122.51
44	156991.12
45	166187.94
46	182901.99
47	191050.39
48	191792.06

```
49   192261.83
Name: Profit, dtype: float64
```

[35]:
```
df.Profit.var
```

[35]:
```
<bound method Series.var of 0192261.83
1     191792.06
2     191050.39
3     182901.99
4     166187.94
5     156991.12
6     156122.51
7     155752.60
8     152211.77
9     149759.96
10    146121.95
11    144259.40
12    141585.52
13    134307.35
14    132602.65
15    129917.04
16    126992.93
17    125370.37
18    124266.90
19    122776.86
20    118474.03
21    111313.02
22    110352.25
23    108733.99
24    108552.04
25    107404.34
26    105733.54
27    105008.31
28    103282.38
29    101004.64
30    99937.59
31    97483.56
32    97427.84
33    96778.92
34    96712.80
35    96479.51
36    90708.19
37    89949.14
38    81229.06
39    81005.76
40    78239.91
```

```
41    77798.83
42    71498.49
43    69758.98
44    65200.33
45    64926.08
46    49490.75
47    42559.73
48    35673.41
49    14681.40
Name: Profit, dtype: float64>
```

[37]:
```
df.Profit.std
```

[37]:
```
<bound method Series.std of 0192261.83
1     191792.06
2     191050.39
3     182901.99
4     166187.94
5     156991.12
6     156122.51
7     155752.60
8     152211.77
9     149759.96
10    146121.95
11    144259.40
12    141585.52
13    134307.35
14    132602.65
15    129917.04
16    126992.93
17    125370.37
18    124266.90
19    122776.86
20    118474.03
21    111313.02
22    110352.25
23    108733.99
24    108552.04
25    107404.34
26    105733.54
27    105008.31
28    103282.38
29    101004.64
30    99937.59
31    97483.56
32    97427.84
```

```
33    96778.92
34    96712.80
35    96479.51
36    90708.19
37    89949.14
38    81229.06
39    81005.76
40    78239.91
41    77798.83
42    71498.49
43    69758.98
44    65200.33
45    64926.08
46    49490.75
47    42559.73
48    35673.41
49    14681.40
Name: Profit, dtype: float64>
```

[39]:
```
df.describe()
```

[39]:

	R&D Spend	Administration	Marketing Spend	Profit
count	50.000000	50.000000	50.000000	50.000000
mean	73721.615600	121344.639600	211025.097800	112012.639200
std	45902.256482	28017.802755	122290.310726	40306.180338
min	0.000000	51283.140000	0.000000	14681.400000
25%	39936.370000	103730.875000	129300.132500	90138.902500
50%	73051.080000	122699.795000	212716.240000	107978.190000
75%	101602.800000	144842.180000	299469.085000	139765.977500
max	165349.200000	182645.560000	471784.100000	192261.830000

[41]:
```
df.describe(include='all')
```

[41]:

	R&D Spend	Administration	Marketing Spend	State	\
count	50.000000	50.000000	50.000000	50	
unique	NaN	NaN	NaN	3	
top	NaN	NaN	NaN	New York	
freq	NaN	NaN	NaN	17	
mean	73721.615600	121344.639600	211025.097800	NaN	
std	45902.256482	28017.802755	122290.310726	NaN	
min	0.000000	51283.140000	0.000000	NaN	

```
25%     39936.370000 103730.875000  129300.132500     NaN
50%     73051.080000 122699.795000  212716.240000     NaN
75%    101602.800000 144842.180000  299469.085000     NaN
max    165349.200000 182645.560000  471784.100000     NaN

              Profit
count      50.000000
unique           NaN
top              NaN
freq             NaN
mean    112012.639200
std      40306.180338
min      14681.400000
25%      90138.902500
50%     107978.190000
75%     139765.977500
max     192261.830000
```

[43]:
```
a=df.columns
a
```

[43]:
```
Index(['R&D Spend', 'Administration', 'Marketing Spend', 'State',
'Profit'], dtype='object')
```

[47]:
```
b=df.values
b
```

[47]:
```
array([[165349.2, 136897.8, 471784.1, 'New York', 192261.83],
       [162597.7, 151377.59, 443898.53, 'California', 191792.06],
       [153441.51, 101145.55, 407934.54, 'Florida', 191050.39],
       [144372.41, 118671.85, 383199.62, 'New York', 182901.99],
       [142107.34, 91391.77, 366168.42, 'Florida', 166187.94],
       [131876.9, 99814.71, 362861.36, 'New York', 156991.12],
       [134615.46, 147198.87, 127716.82, 'California', 156122.51],
       [130298.13, 145530.06, 323876.68, 'Florida', 155752.6],
       [120542.52, 148718.95, 311613.29, 'New York', 152211.77],
       [123334.88, 108679.17, 304981.62, 'California', 149759.96],
       [101913.08, 110594.11, 229160.95, 'Florida', 146121.95],
       [100671.96, 91790.61, 249744.55, 'California', 144259.4],
       [93863.75, 127320.38, 249839.44, 'Florida', 141585.52],
```

```
       [91992.39, 135495.07, 252664.93, 'California', 134307.35],
       [119943.24, 156547.42, 256512.92, 'Florida', 132602.65],
       [114523.61, 122616.84, 261776.23, 'New York', 129917.04],
       [78013.11, 121597.55, 264346.06, 'California', 126992.93],
       [94657.16, 145077.58, 282574.31, 'New York', 125370.37],
       [91749.16, 114175.79, 294919.57, 'Florida', 124266.9],
       [86419.7, 153514.11, 0.0, 'New York', 122776.86],
       [76253.86, 113867.3, 298664.47, 'California', 118474.03],
       [78389.47, 153773.43, 299737.29, 'New York', 111313.02],
       [73994.56, 122782.75, 303319.26, 'Florida', 110352.25],
       [67532.53, 105751.03, 304768.73, 'Florida', 108733.99],
       [77044.01, 99281.34, 140574.81, 'New York', 108552.04],
       [64664.71, 139553.16, 137962.62, 'California', 107404.34],
       [75328.87, 144135.98, 134050.07, 'Florida', 105733.54],
       [72107.6, 127864.55, 353183.81, 'New York', 105008.31],
       [66051.52, 182645.56, 118148.2, 'Florida', 103282.38],
       [65605.48, 153032.06, 107138.38, 'New York', 101004.64],
       [61994.48, 115641.28, 91131.24, 'Florida', 99937.59],
       [61136.38, 152701.92, 88218.23, 'New York', 97483.56],
       [63408.86, 129219.61, 46085.25, 'California', 97427.84],
       [55493.95, 103057.49, 214634.81, 'Florida', 96778.92],
       [46426.07, 157693.92, 210797.67, 'California', 96712.8],
       [46014.02, 85047.44, 205517.64, 'New York', 96479.51],
       [28663.76, 127056.21, 201126.82, 'Florida', 90708.19],
       [44069.95, 51283.14, 197029.42, 'California', 89949.14],
       [20229.59, 65947.93, 185265.1, 'New York', 81229.06],
       [38558.51, 82982.09, 174999.3, 'California', 81005.76],
       [28754.33, 118546.05, 172795.67, 'California', 78239.91],
       [27892.92, 84710.77, 164470.71, 'Florida', 77798.83],
       [23640.93, 96189.63, 148001.11, 'California', 71498.49],
       [15505.73, 127382.3, 35534.17, 'New York', 69758.98],
       [22177.74, 154806.14, 28334.72, 'California', 65200.33],
       [1000.23, 124153.04, 1903.93, 'New York', 64926.08],
       [1315.46, 115816.21, 297114.46, 'Florida', 49490.75],
       [0.0, 135426.92, 0.0, 'California', 42559.73],
       [542.05, 51743.15, 0.0, 'New York', 35673.41],
       [0.0, 116983.8, 45173.06, 'California', 14681.4]],
      dtype=object)
```

[ ]:

[ ]:

[14]:
```
import seaborn as sns
%matplotlib inline
sns.displot(array)
```

4.OUTLIER DETECTION

[ ]:
```
#EX NO:2
#OUTLIER DETECTION 30/07/2024
#ARITRA GUPTA
#230701033
#CSE A
```

[2]:
```
import numpy as np
array=np.random.randint(1,100,16) # randomly generate 16 numbers between 1 to 100
array
```

[2]:
```
array([76, 61, 80, 12, 8, 54, 41, 18, 98, 82, 5, 15, 14, 55,
67, 70])
```

[4]:
```
array.mean()
```

[4]:
```
47.25
```

[6]:
```
np.percentile(array,25)
```

[6]:
```
14.75
```

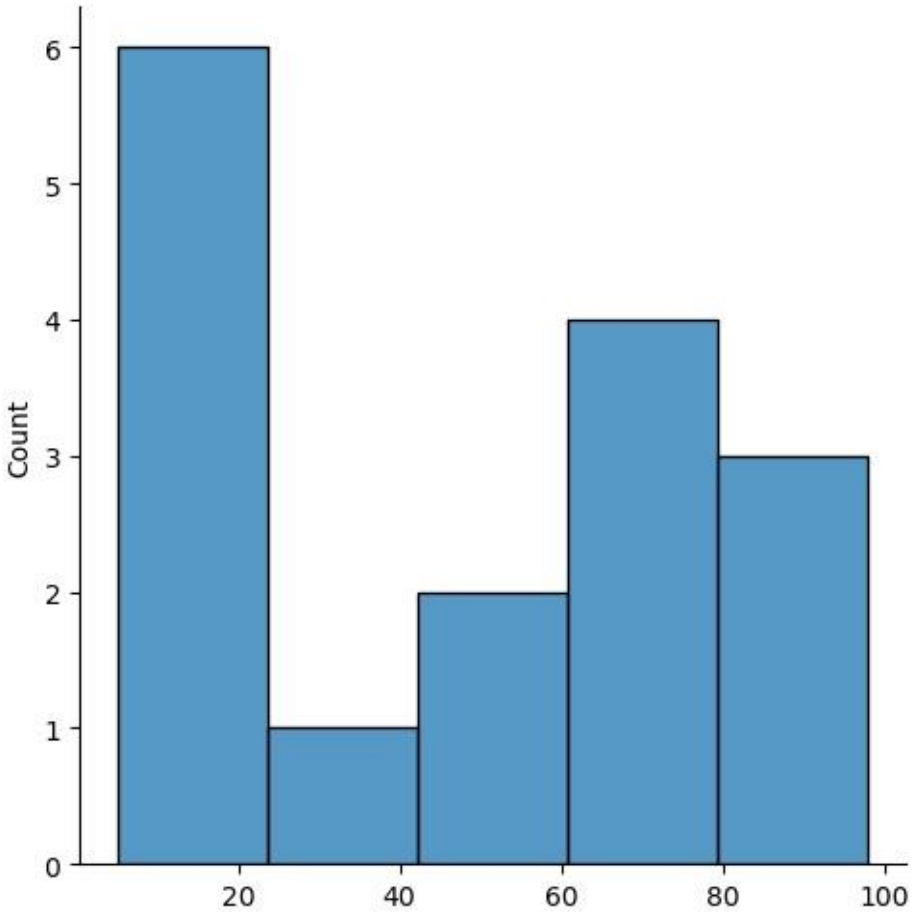
[8]:
```
np.percentile(array,75)
```

[8]:
```
71.5
```

[12]:
```
#outliers detection
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
```

[12]:
```
(-70.375, 156.625)
```

[14]:
```
<seaborn.axisgrid.FacetGrid at 0x1d3957026f0>
```

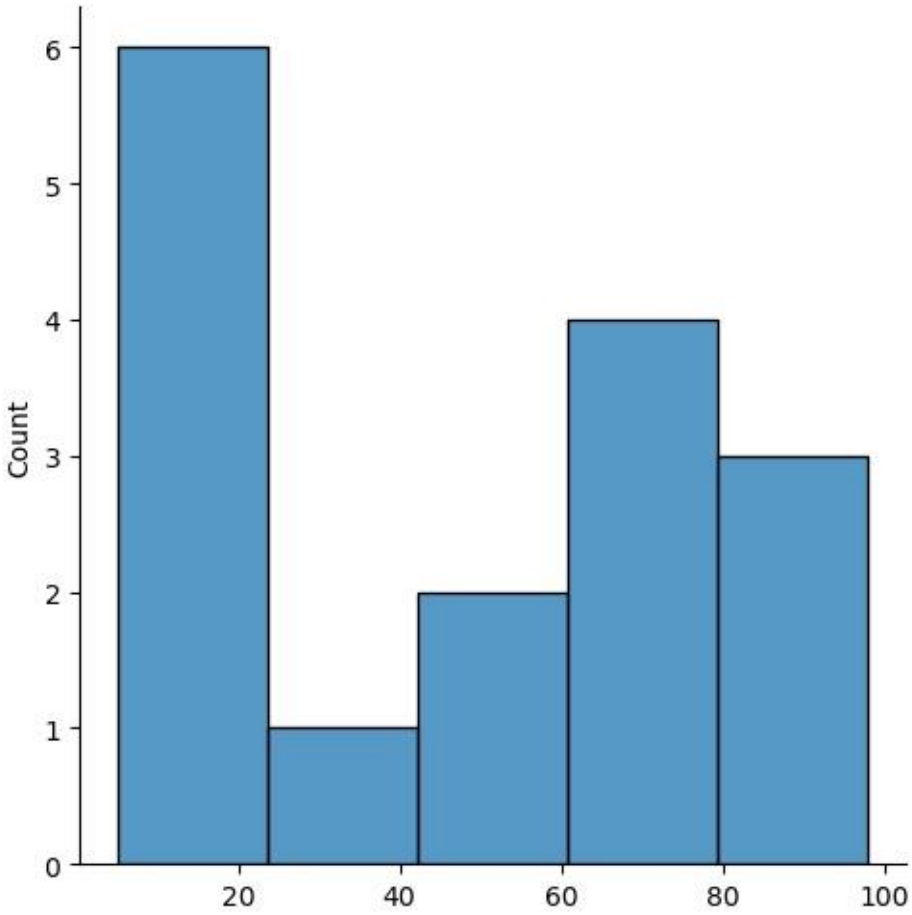


[16]:
```
new_array=array[(array>lr) & (array<ur)]
new_array
```

[16]:
```
array([76, 61, 80, 12, 8, 54, 41, 18, 98, 82, 5, 15, 14, 55,
67, 70])
```

[18]:
```
sns.displot(new_array)
```

[18]:
```
<seaborn.axisgrid.FacetGrid at 0x1d390e4be30>
```



[20]:
```
lr1,ur1=outDetection(new_array)
lr1,ur
```

[20]: (-70.375, 156.625)

[25]:
```
final_array=new_array[(new_array>lr1) & (new_array<ur1)]
final_array
```

[25]: array([76, 61, 80, 12, 8, 54, 41, 18, 98, 82, 5, 15, 14, 55, 67, 70])

[ ]:
```

```

5 MISSING AND INAPPROPRIATE DATA

[ ]:
```
#EX NO:3
#MISSING AND INAPPROPRIATE DATA 20/08/2024
#ARITRA GUPTA
#230701033
#CSE A
```

[3]:
```
import numpy as np
import pandas as pd
df=pd.read_csv("hotel_data_set.csv")
df
```

[3]:
```
    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
```

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

[5]:
```
0    False
1    False
2    False
3    False
4    False
```

```
5    False
6    False
7    False
8    False
9     True
10   False
dtype: bool
```

[7]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 11 entries, 0 to
10 Data columns (total 9
columns):
#   Column         Non-Null Count Dtype
--- ------         -------------- -----
0   CustomerID     11 non-null   int64
1   Age_Group      11 non-null   object
2   Rating(1-5)    11 non-null   int64
3   Hotel          11 non-null   object
4   FoodPreference 11 non-null   object
5   Bill           11 non-null   int64
6   NoOfPax        11 non-null   int64
7  EstimatedSalary 11 non-null  int64
8   Age_Group.1    11 non-null   object
dtypes: int64(5), object(4)
memory usage: 924.0+ bytes
```

[9]:
```
df.drop_duplicates(inplace=True)
df
```

[9]:

	CustomerID	Age_Group	Rating(1-5)	Hotel	FoodPreference	Bill	NoOfPax	EstimatedSalary	Age_Group.1
0	1	20-25	4	Ibis	veg	1300	2	40000	20-25
1	2	30-35	5	LemonTree	Non-Veg	2000	3	59000	30-35
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			

```
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
```

[11]:
```
len(df)
```

[11]: 10

[13]:
```
index=np.array(list(range(0,len(df))))
df.set_index(index,inplace=True)
index
```

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

[15]:
```
df.drop(['Age_Group.1'],axis=1,inplace=True)
df
```

[15]:

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

```
0           40000
1           59000
2           30000
3           120000
4           45000
5           122220 6   21122
7     345673
8     -99999 9   87777 [21]:
df.EstimatedSalary.fillna(round(df.Est
imatedSalary.mean()))
df.NoOfPax.fillna(round(df.NoOfPax.med
ian()))
df['Rating(1-5)'].fillna(round(df['Rating(1-
5)'].median()))
df.Bill.fillna(round(df.Bill.mean())) df
```

[21]:
```
 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
```

[23]:
```
df.Age_Group.unique()
```

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

[25]:
```
df.Hotel.unique()
```

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

[29]:
```
df.Hotel.replace(['Ibys'],'Ibis')
```

[29]:
```
         Ibis
0
     1   LemonTree
     2      RedFox
     3   LemonTree
     4        Ibis
     5        Ibis
     6      RedFox
     7   LemonTree
      8        Ibis
      9        RedFox
     Name: Hotel, dtype: object
```

6.DATA PRE PROCESSING

[ ]:
```
#EX NO:4
#DATA PREPROCESSING 27/08/2024
#ARITRA GUPTA
#230701033
#CSE A
```

[34]:
```
import numpy as np
import pandas as pd
df=pd.read_csv("2_datasetExample.csv")
df
```

[34]:

	SNO	RNO	NAME	MARKS
0	1	230701001	AADITYA PARTHA SARATHY	40
1	2	230701002	AAKASH V	44
2	3	230701003	ABHILASH G R	44
3	4	230701004	ABHINAYA LAKSHMI S	48
4	5	230701005	ABHISHEK ROBIN S A	16
..	…	…	…	…
65	66	230701504	KAAVIYA R	16
66	67	230701507	MAGESH VASAN M	38
67	68	230701510	SARANYA M	44
68	69	230701514	GANESHAN M	14
69	70	230701521	JABARAJ E	9

[70 rows x 4 columns]

[36]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 70 entries, 0 to
69 Data columns (total 4
columns):
 #  Column Non-Null Count Dtype
--- ------ -------------- -----
 0   SNO    70 non-null    int64
 1   RNO    70 non-null    int64
 2   NAME   70 non-null    object
```

```
 3   MARKS   70 non-null      int64
dtypes: int64(3), object(1)
memory usage: 2.3+ KB
```

[40]:
```
df.MARKS.mode()
```

[40]:
```
0   40
Name: MARKS, dtype: int64
```

[42]:
```
df.MARKS.mode()[0]
```

[42]:
```
40
```

[44]:
```
type(df.MARKS.mode())
```

[44]:
```
pandas.core.series.Series
```

[48]:
```
df.MARKS.fillna(df.MARKS.mode()[0])
```

[48]:
```
0    40
1    44
2    44
3    48
4    16
..
65    16
66    38
67    44
68    14
69    9
Name: MARKS, Length: 70, dtype: int64
```

[50]:
```
df.MARKS.fillna(df.MARKS.median())
```

[50]:
```
0    40
1    44
2    44
3    48
4    16
..
```

```
65    16
66    38
67    44
68    14
69     9
Name: MARKS, Length: 70, dtype: int64
```

[52]:
```
df
```

[52]:
```
    SNO       RNO                  NAME MARKS
0     1 230701001 AADITYA PARTHA SARATHY     40
1     2 230701002AAKASH V   44
2     3 230701003ABHILASH G R     44
3     4 230701004ABHINAYA LAKSHMI S    48
4     5 230701005ABHISHEK ROBIN S A    16
      .. …       …                   …    …
65   66 230701504KAAVIYA R  16
66   67 230701507MAGESH VASAN M   38
67   68 230701510SARANYA M  44
68   69 230701514GANESHAN M 14
69   70 230701521JABARAJ E  9
     [70 rows x 4 columns]
```

[54]:
```
pd.get_dummies(df.NAME)
```

[54]:
```
 AADITYA PARTHA SARATHY AAKASH V ABHILASH G R ABHINAYA LAKSHMI S \
     0                   True    False       False             False
     1                  False     True       False             False
     2                  False    False        True             False
     3                  False    False       False              True
     4                  False    False       False             False
     ..                   …      …          …                 …
```

65	False	False	False		False
66	False	False	False		False
67	False	False	False		False
68	False	False	False		False
69	False	False	False		False

	ABHISHEK ROBIN S A	ABHISHEK S	ABINAV S T	ABIRAMI K	ABISHEK I \
0	False	False	False	False	False
1	False	False	False	False	False
2	False	False	False	False	False
3	False	False	False	False	False
4	True	False	False	False	False
..	…	…	…	…	…
65	False	False	False	False	False
66	False	False	False	False	False
67	False	False	False	False	False
68	False	False	False	False	False
69	False	False	False	False	False

	ABISHEK NATARAJAN …	DARSHAN S	DAYANITHI V	DEEPA S	DEEPAK K \
0	False …	False	False	False	False
1	False …	False	False	False	False
2	False …	False	False	False	False
3	False …	False	False	False	False
4	False …	False	False	False	False
..	… …	…	…	…	…
65	False …	False	False	False	False
66	False …	False	False	False	False
67	False …	False	False	False	False
68	False …	False	False	False	False
69	False …	False	False	False	False

	GANESHAN M H	AKSHITHAA	JABARAJ E	KAAVIYA R	MAGESH VASAN M	SARANYA M
0	False	False	False	False	False	False
1	False	False	False	False	False	False
2	False	False	False	False	False	False

```
3       False      False    False     False         False     False
4       False      False    False     False         False     False
..        …          …        …         …             …         …
65      False      False    False      True         False     False
66      False      False    False     False          True     False
67      False      False    False     False         False      True
68       True      False    False     False         False     False
69      False      False     True     False         False     False
[70 rows x 69 columns]
```

[56]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 70 entries, 0 to
69 Data columns (total 4
columns):
 #     Column Non-Null Count
Dtype --- ------ --------------
-----
  0    SNO   70 non-null      int64
  1    RNO   70 non-null      int64
  2    NAME  70 non-null      object
  3    MARKS 70 non-null      int64 dtypes: int64(3), object(1)
 memory usage: 2.3+ KB
```

[ ]:
```

```

7.EDA

[ ]:
```
#EX NO:5
#EDA,QUANTITATIVE AND QUALITATIVE DATA 03/09/2024
#ARITRA GUPTA
#230701033
#CSE A
```

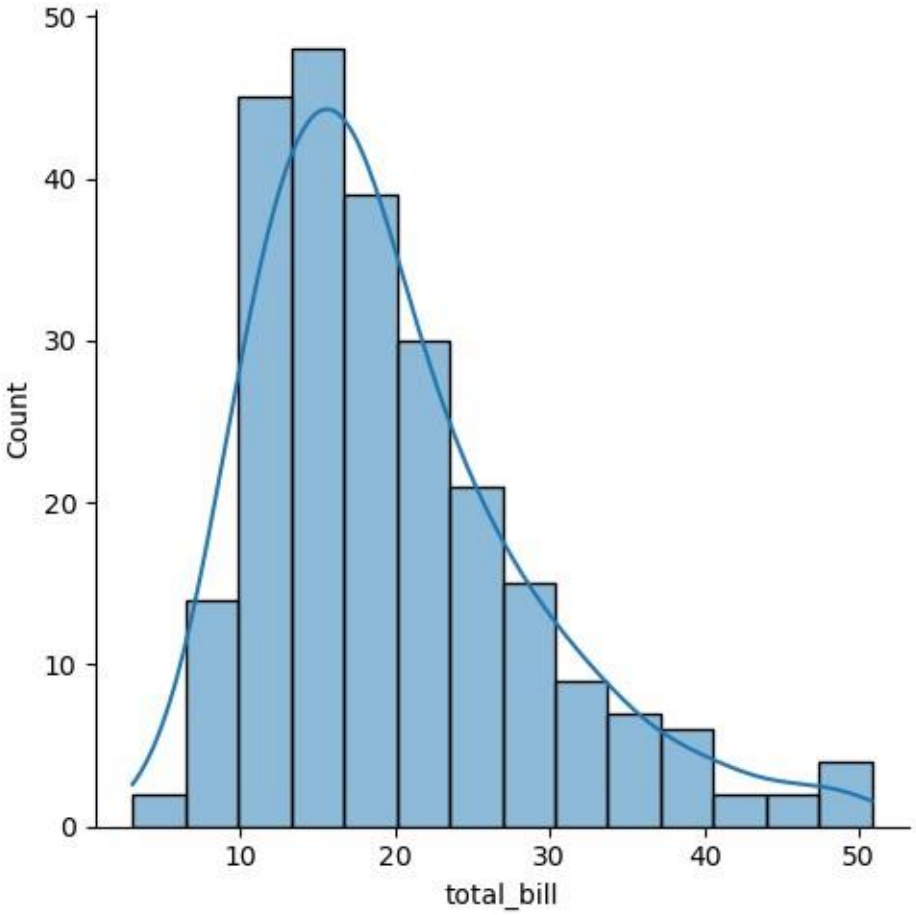
[63]:
```
import seaborn as sns
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
%matplotlib inline
tips=sns.load_dataset('tips')
tips.head()
```

[63]:

	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

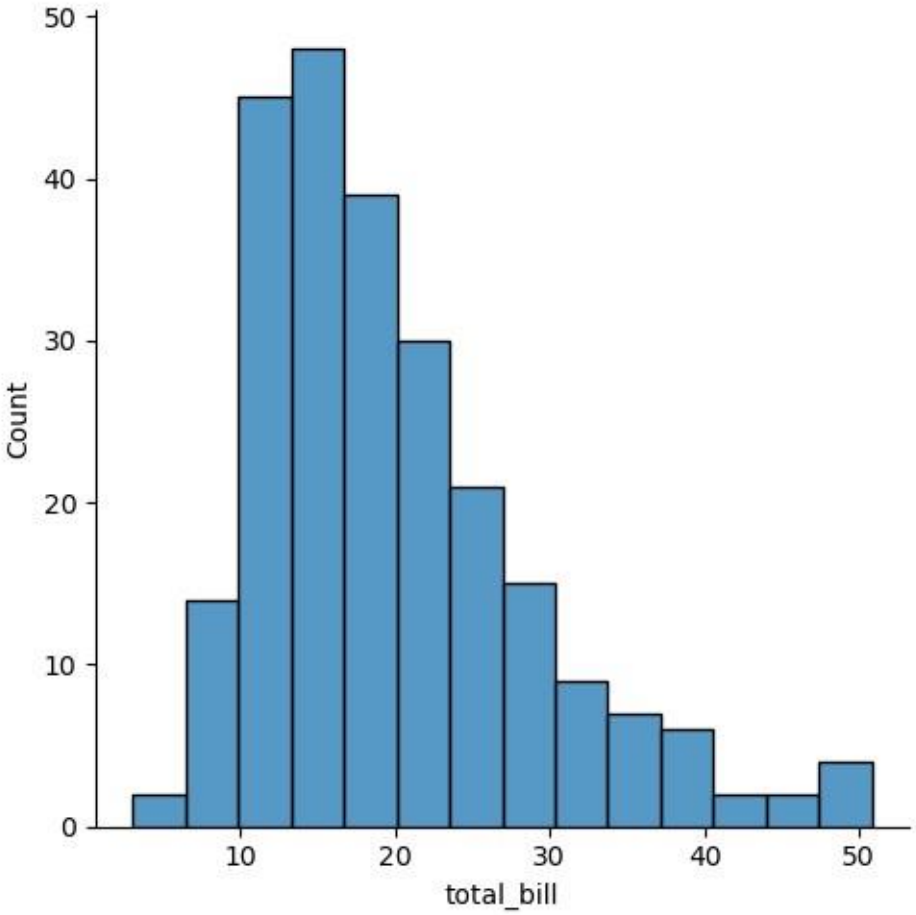
[65]:
```
sns.displot(tips.total_bill,kde=True)
```

[65]:
```
<seaborn.axisgrid.FacetGrid at 0x229166f4b00>
```



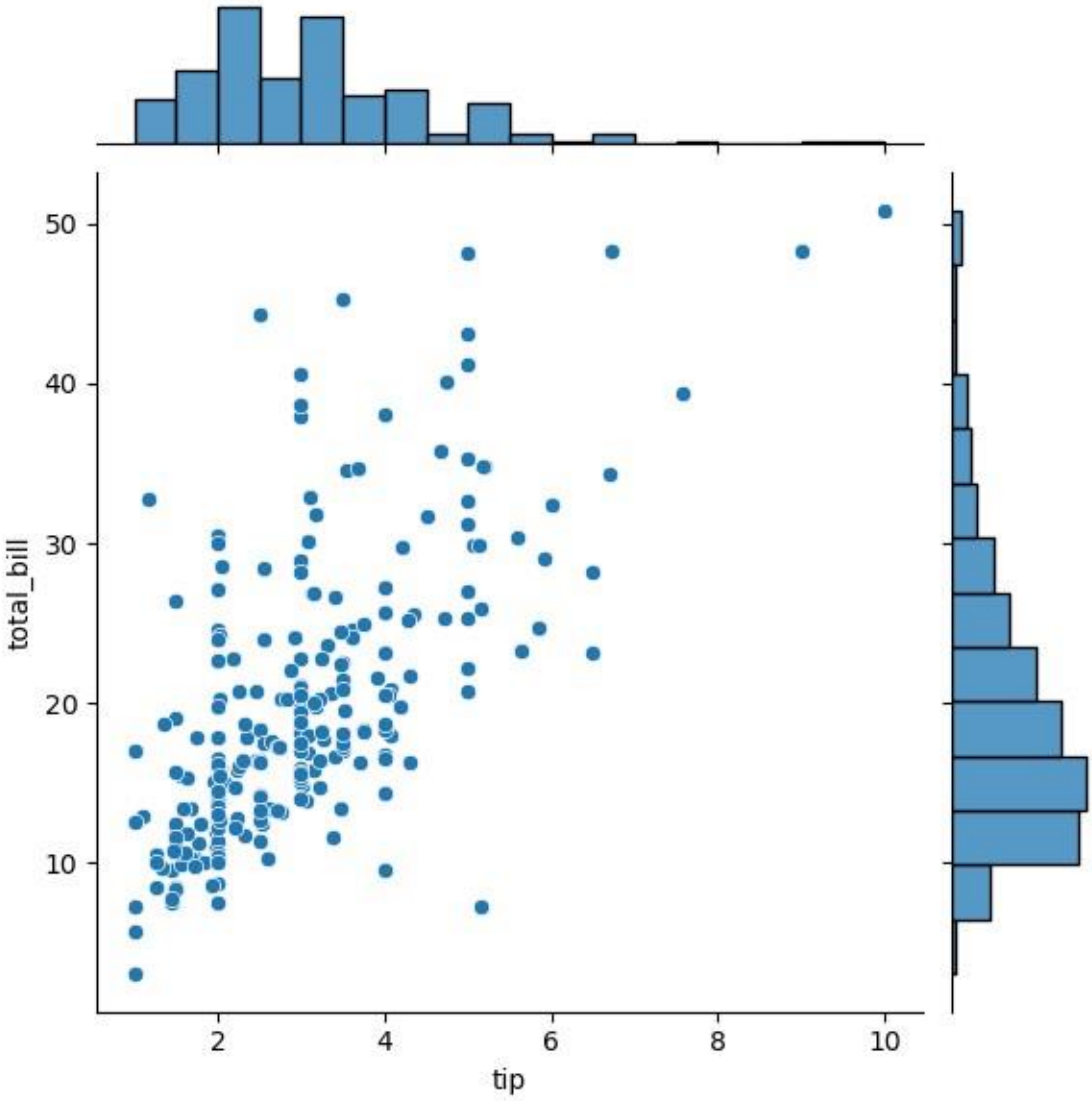
[67]:
```
sns.displot(tips.total_bill,kde=False)
```

[67]: <seaborn.axisgrid.FacetGrid at 0x229183d7b00>



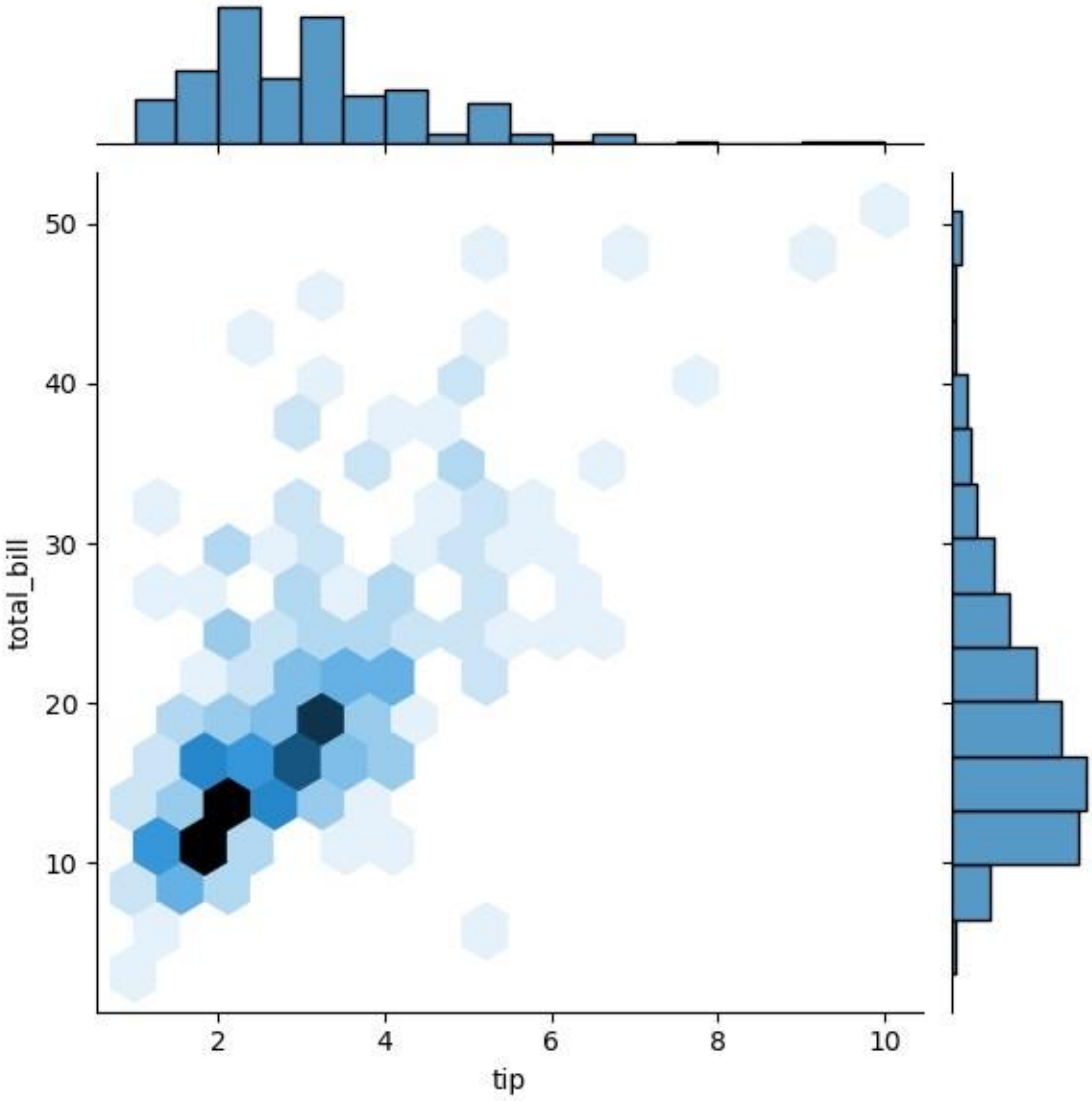
[69]:
```
sns.jointplot(x=tips.tip,y=tips.total_bill)
```

[69]: <seaborn.axisgrid.JointGrid at 0x22911d47650>



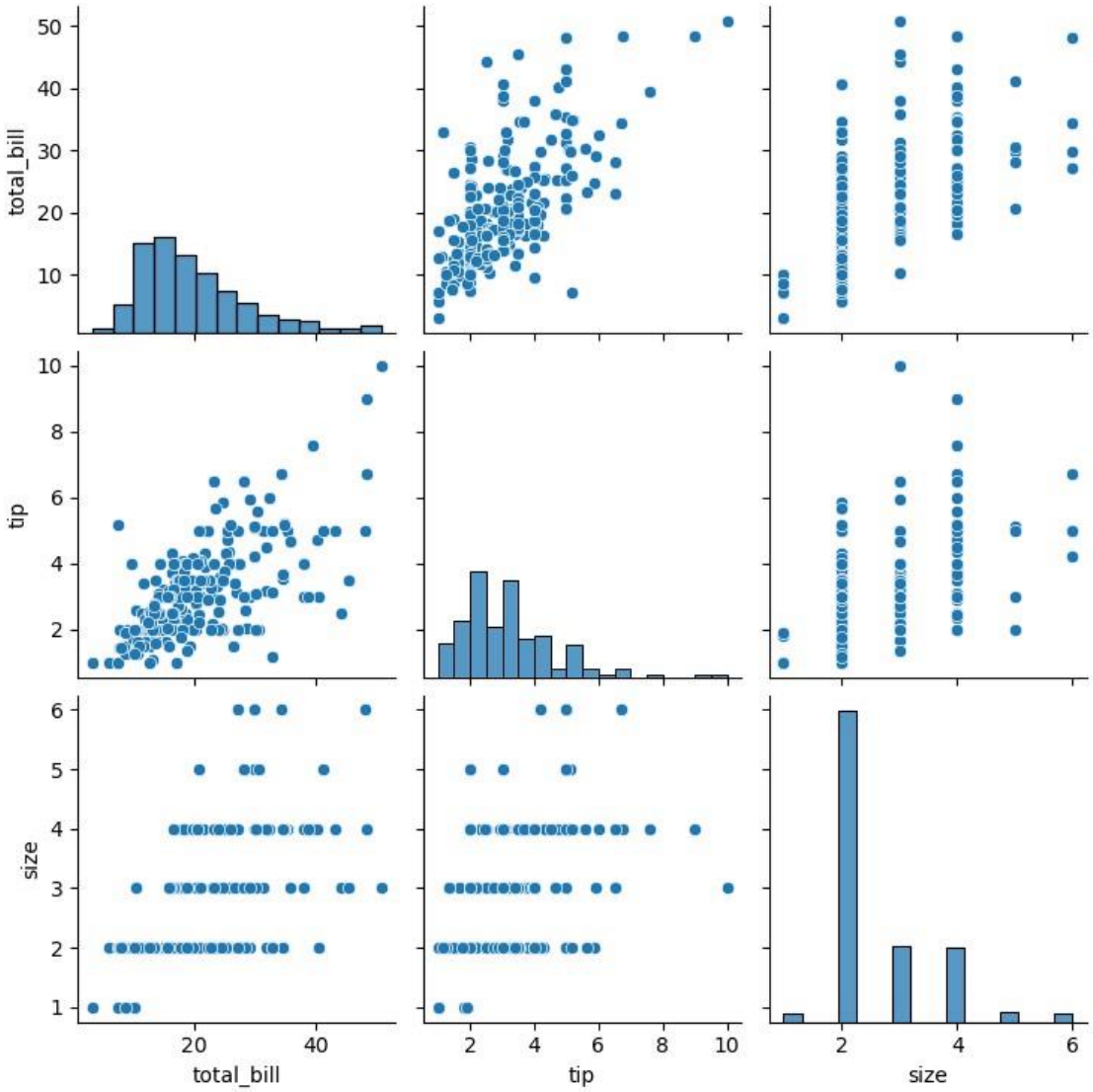
[71]:
```
sns.jointplot(x=tips.tip,y=tips.total_bill,kind="hex"
)
```

[71]: <seaborn.axisgrid.JointGrid at 0x2291850c6e0>



[73]:
```
sns.pairplot(tips)
```

[73]: <seaborn.axisgrid.PairGrid at 0x229184b9e80>



[75]:
```
tips.time.value_counts()
```

[75]:
```
time
Dinner    176
Lunch      68
Name: count, dtype: int64
```

[ ]:

```

```

8 RANDOM SAMPLING

```
#EX NO:6
#RANDOM SAMPLING 10/09/2024
#ARITRA GUPTA
#230701033
#CSE A
```

[182]:
```
import numpy as np
import matplotlib.pyplot as plt
```

[184]:
```
population_mean = 50
population_std = 10
population_size = 100000
population = np.random.normal(population_mean, population_std, population_size)
```

[186]:
```
sample_sizes = [30, 50, 100] # different sample sizes to consider
num_samples = 1000 # number of samples for each sample size
sample_means = {}
for size in sample_sizes:
    sample_means[size] = []
```

[188]:
```
for _ in range(num_samples):
    sample = np.random.choice(population, size=size, replace=False)
    sample_means[size].append(np.mean(sample))
```

[189]:
```
plt.figure(figsize=(12, 8))
```

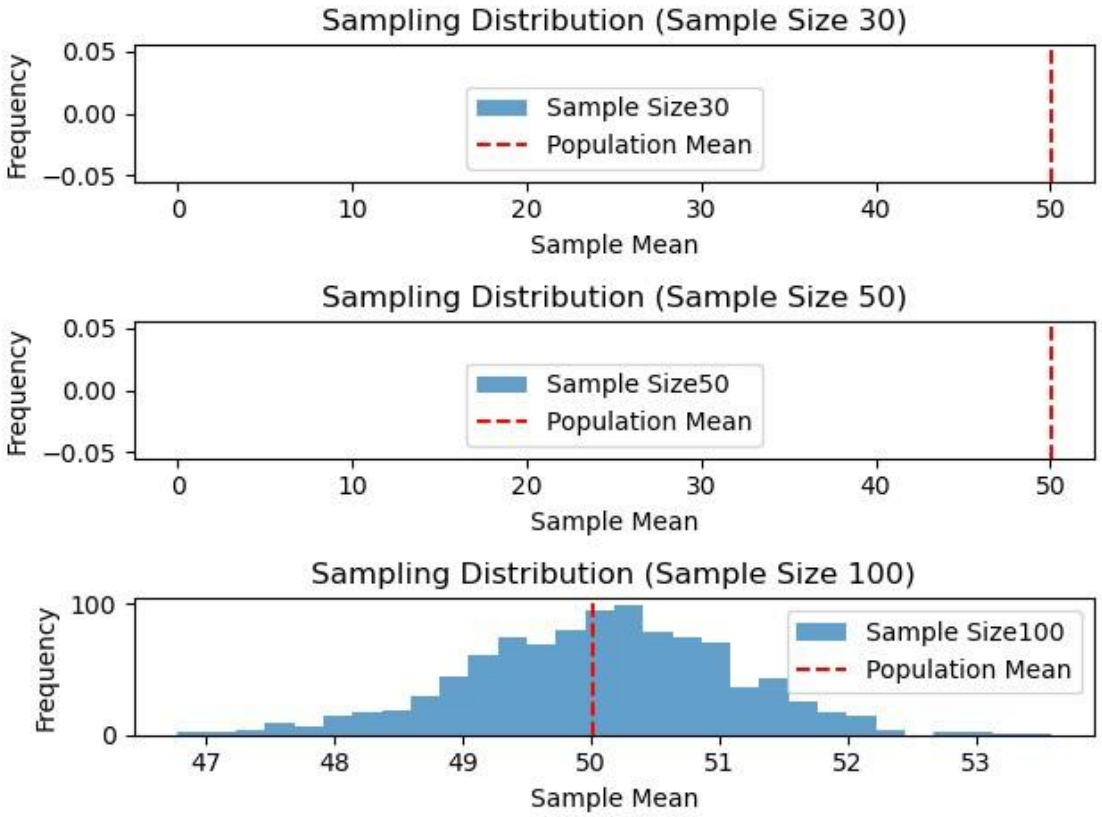
[189]:
```
<Figure size 1200x800 with 0 Axes>
```

<Figure size 1200x800 with 0 Axes>

[190]:
```
for i, size in enumerate(sample_sizes):
    plt.subplot(len(sample_sizes), 1, i+1)
    plt.hist(sample_means[size], bins=30, alpha=0.7, label=f'Sample
    Size{size}') plt.axvline(np.mean(population), color='red',
    linestyle='dashed',␣
 ↪linewidth=1.5,label='Population Mean')
    plt.title(f'Sampling Distribution (Sample Size
    {size})') plt.xlabel('Sample Mean')
    plt.ylabel('Frequency')
```

[ ]:

```
    plt.legend()
plt.tight_layout()
plt.show()
```



[ ]:

[ ]:

[ ]:

9 Z TEST

```
#EX NO:7
#Z-TEST 10/09/2024
#ARITRA GUPTA
#230701033
#CSE A
```

[236]:
```
import numpy as np
import scipy.stats as stats
```

[238]:
```
sample_data = np.array([152, 148, 151, 149, 147, 153, 150, 148, 152,
149,151, 150, 149, 152, 151, 148, 150, 152, 149, 150,148, 153, 151,
150, 149, 152, 148, 151, 150, 153])
```

[240]:
```
population_mean = 150
sample_mean = np.mean(sample_data)
sample_std = np.std(sample_data, ddof=1)
```

[242]:
```
n = len(sample_data)
z_statistic = (sample_mean - population_mean) / (sample_std /
np.sqrt(n))
p_value = 2 * (1 - stats.norm.cdf(np.abs(z_statistic)))
```

[244]:
```
print(f"Sample Mean: {sample_mean:.2f}")
print(f"Z-Statistic: {z_statistic:.4f}")
print(f"P-Value: {p_value:.4f}")
```

```
Sample Mean: 150.20
Z-Statistic: 0.6406
P-Value: 0.5218
```

[246]:
```
 alpha = 0.05 if
p_value < alpha:
          print("Reject the null hypothesis: The average weight is
                                                  significantly␣
 ↪different from 150 grams.")
else:
    print("Fail to reject the null hypothesis: There is no
    significant␣
  ↪difference in average weight from 150 grams.")
```

```
Fail to reject the null hypothesis: There is no significant
difference in average weight from 150 grams.
```

[ ]:
```

```

[ ]:
```

```

[ ]:

10 T TEST

```
#EX NO:8
#T-TEST 08/10/2024
#ARITRA GUPTA
#230701033
#CSE A
```

[262]:
```
import numpy as np
import scipy.stats as stats
```

[264]:
```
np.random.seed(42)
sample_size = 25
sample_data = np.random.normal(loc=102, scale=15, size=sample_size)
```

[266]:
```
population_mean = 100
sample_mean = np.mean(sample_data)
sample_std = np.std(sample_data, ddof=1)
```

[268]:
```
n = len(sample_data)
t_statistic, p_value = stats.ttest_1samp(sample_data,population_mean)
```

[270]:
```
print(f"quot;Sample Mean: {sample_mean:.2f}")
print(f"T-Statistic: {t_statistic:.4f}")
print(f"P-Value: {p_value:.4f}")
```

```
quot;Sample Mean: 99.55
T-Statistic: -0.1577
P-Value: 0.8760
```

[272]:
```
 alpha = 0.05 if
p_value < alpha:
         print("Reject the null hypothesis: The average IQ SCORE is
                                                    significantly␣
 ↪different from 100.")
else:
    print("Fail to reject the null hypothesis: There is no
     significant␣
  ↪difference in average of IQ Score from 100.")
```

```
Fail to reject the null hypothesis: There is no significant
difference in average of IQ Score from 100.
```

[ ]:

]:

[ ]:

[ ]:

11 ANOVA TEST

```
#EX NO:9
#ANOVA-TEST 08/10/2024
#ARITRA GUPTA
#230701033
#CSE A
```

[302]:
```
import numpy as np
import scipy.stats as stats
```

[304]:
```
np.random.seed(42)
n_plants = 25
growth_A = np.random.normal(loc=10, scale=2, size=n_plants)
growth_B = np.random.normal(loc=12, scale=3, size=n_plants)
growth_C = np.random.normal(loc=15, scale=2.5, size=n_plants)
```

[306]:
```
all_data = np.concatenate([growth_A, growth_B, growth_C])
treatment_labels = ['A'] * n_plants + ['B'] * n_plants + ['C'] * n_plants
```

[308]:
```
f_statistic, p_value = stats.f_oneway(growth_A, growth_B, growth_C)
```

[310]:
```
print("Treatment A Mean Growth:&quot;, np.mean(growth_A) ")
print("Treatment B Mean Growth:&quot;, np.mean(growth_B) ")
print("Treatment C Mean Growth:&quot;, np.mean(growth_C) ")
print()
print(f"F-Statistic: {f_statistic:.4f}")
print(f"P-Value: {p_value:.4f}")
```

```
Treatment A Mean Growth:&quot;, np.mean(growth_A)
Treatment B Mean Growth:&quot;, np.mean(growth_B)
Treatment C Mean Growth:&quot;, np.mean(growth_C)

F-Statistic: 36.1214 P-
Value: 0.0000
```

[312]:
```
 alpha = 0.05 if
p_value < alpha:
print("Reject the null hypothesis: There is a significant difference
                                                                in␣
↪mean growth rates among the three treatments.")
else:
    print("Fail to reject the null hypothesis: There is no
    significant␣
```

```
    ↪difference in mean growth rates among the three treatments.")
```

```
Reject the null hypothesis: There is a significant difference in
mean growth rates among the three treatments.
```

[314]:
```
if p_value < alpha: from statsmodels.stats.multicomp import
   pairwise_tukeyhsd tukey_results = pairwise_tukeyhsd(all_data,
   treatment_labels, alpha=0.05) print("\nTukey's HSD Post-hoc
   Test:") print(tukey_results)
```

```
Tukey's HSD Post-hoc Test:
Multiple Comparison of Means - Tukey HSD,
FWER=0.05
=============================================
======= group1 group2 meandiff p-adj lower
upper reject
---------------------------------------------------
    A     B 1.4647 0.0877 -0.1683 3.0977 False
  A     C  5.5923     0.0 3.9593 7.2252     True
  B     C  4.1276     0.0 2.4946 5.7605     True
    ---------------------------------------------------
```

[ ]:
```
```

12 FEATURE SCALING

```
#EX NO:10
#FEATURE SCALING 22/10/2024
#ARITRA GUPTA
#230701033
#CSE A
```

[84]:
```
import numpy as np
import pandas as pd
df=pd.read_csv('2_datasetExample.csv')
df
```

[84]:

	SNO	RNO	NAME	MARKS
0	1	230701001	AADITYA PARTHA SARATHY	40
1	2	230701002	AAKASH V	44
2	3	230701003	ABHILASH G R	44

[ ]:

```
3     4 230701004ABHINAYA LAKSHMI S    48
4     5 230701005ABHISHEK ROBIN S A    16
       .. …        …                   …    …
65   66 230701504KAAVIYA R  16
66   67 230701507MAGESH VASAN M   38
67   68 230701510SARANYA M  44
68   69 230701514GANESHAN M 14
69   70 230701521JABARAJ E  9
       [70 rows x 4 columns]
```

[86]:
```
df.head()
```

[86]:
```
   SNO       RNO                   NAME MARKS
0    1 230701001 AADITYA PARTHA SARATHY     40
1    2 230701002 AAKASH V   44
2    3 230701003 ABHILASH G R     44
3    4 230701004 ABHINAYA LAKSHMI S    48
4    5 230701005 ABHISHEK ROBIN S A    16
```

[94]:
```
df.MARKS.fillna(df.MARKS.mode()[0])
features=df.iloc[:,:-1].values
df
```

[94]:
```
     SNO       RNO                    NAME MARKS
0     1 230701001 AADITYA PARTHA SARATHY     40
1     2 230701002AAKASH V   44
2     3 230701003ABHILASH G R     44
3     4 230701004ABHINAYA LAKSHMI S    48
4     5 230701005ABHISHEK ROBIN S A    16
       .. …        …                   …    …
65   66 230701504KAAVIYA R  16
66   67 230701507MAGESH VASAN M   38
67   68 230701510SARANYA M  44
68   69 230701514GANESHAN M 14
69   70 230701521JABARAJ E  9
```

```
[70 rows x 4 columns]
```

[98]:
```
label=df.iloc[:,-1].values   from   sklearn.impute
import                                SimpleImputer
age=SimpleImputer(strategy="mean",missing_values=np
.nan)
Salary=SimpleImputer(strategy="mean",missing_values
=np.nan) age.fit(features[:,[1]])
```

[98]:
```
SimpleImputer()
```

[106]:
```
SimpleImputer()
```

[106]:
```
SimpleImputer()
```

[114]:
```
features[:,[1]]=age.transform(features[:,[1]])
features
```

[114]:
```
array([[1, 230701001.0, 'AADITYA PARTHA SARATHY'],
       [2, 230701002.0, 'AAKASH V'],
       [3, 230701003.0, 'ABHILASH G R'],
       [4, 230701004.0, 'ABHINAYA LAKSHMI S'],
       [5, 230701005.0, 'ABHISHEK ROBIN S A'],
       [6, 230701006.0, 'ABHISHEK S'],
       [7, 230701007.0, 'ABINAV S T'],
       [8, 230701008.0, 'ABIRAMI K'],
       [9, 230701009.0, 'ABISHEK I'],
       [10, 230701010.0, 'ABISHEK NATARAJAN'],
       [11, 230701011.0, 'ABOORVAN SHANMUGAPRIYA BABU'],
       [12, 230701012.0, 'ADHAVAN BALAJI N M'],
       [13, 230701013.0, 'ADITHYA J'],
       [14, 230701014.0, 'ADITHYAA SURESH'],
       [15, 230701015.0, 'AISHWARYA A'],
       [16, 230701016.0, 'AISHWARYA M'],
       [17, 230701017.0, 'AJAY SRINIVAS R'],
       [18, 230701018.0, 'AJEESH R R'],
```

[19, 230701019.0, 'AKASH N'],
[20, 230701020.0, 'AKILESH PRASAD I K'],
[21, 230701021.0, 'AKSHAY KUMAR S'],
[22, 230701022.0, 'AKSHAY VENKAT KRISHNA'],
[23, 230701023.0, 'AKSHAYA BALAJI NITHYANANDAN'],
[24, 230701024.0, 'AKSHAYA SRI S'],
[25, 230701025.0, 'H AKSHITHAA'],
[26, 230701026.0, 'ALFRED SAM D'],
[27, 230701027.0, 'AMIRTHAVARSHINI R U'],
[28, 230701028.0, 'ANIRUDH C'],
[29, 230701029.0, 'ANIRUDH S'],
[30, 230701030.0, 'ANU S'],
[31, 230701031.0, 'ARAVINDAN S G'],
[32, 230701032.0, 'ARAVINTHAA S'],
[33, 230701033.0, 'ARITRA GUPTA'],
[34, 230701034.0, 'ARUL JOTHI P'],
[35, 230701035.0, 'ARUL RAJAN S'],
[36, 230701036.0, 'ARUN M C'],
[37, 230701037.0, 'ARUN PRAKASH M'],
[38, 230701038.0, 'ARVIND RAVI'],
[39, 230701039.0, 'ARYA SUBANANTH R K'],
[40, 230701040.0, 'ARYAN SAI VENKAT M'],
[41, 230701041.0, 'ASHISH P SHAJI'],
[42, 230701042.0, 'ASHNA V'],
[43, 230701043.0, 'ASHWIN KUMAR A P'],
[44, 230701044.0, 'ASWINKUMAR J'],
[45, 230701045.0, 'ATCHAYA S'],
[46, 230701046.0, 'ATHIENA RACHEL J'],
[47, 230701047.0, 'ATHIRA D R'],
[48, 230701048.0, 'AWINTHIKA SANTHANAM'],
[49, 230701049.0, 'BALAJI C'],
[50, 230701051.0, 'BERNIEO FATIM A'],
[51, 230701052.0, 'BHARATH B'],
[52, 230701053.0, 'BHARATH KUMAR M'],
[53, 230701054.0, 'BHARRATH K'],
[54, 230701055.0, 'BHUVANESHWARI K'],
[55, 230701056.0, 'BOOTHALINGESH N'],
[56, 230701057.0, 'BOSEBALA T'],
[57, 230701058.0, 'BRIJITH MANIKANDAN P'],
[58, 230701059.0, 'CHANDNI M N'],
[59, 230701060.0, 'DANIEL LEVE MANICKAM D A'],
[60, 230701061.0, 'DARSHAN M'],
[61, 230701062.0, 'DARSHAN M'],
[62, 230701063.0, 'DARSHAN S'],
[63, 230701064.0, 'DAYANITHI V'],
[64, 230701065.0, 'DEEPA S'],
[65, 230701066.0, 'DEEPAK K'],

```
        [66, 230701504.0, 'KAAVIYA R'],
        [67, 230701507.0, 'MAGESH VASAN M'],
        [68, 230701510.0, 'SARANYA M'],
        [69, 230701514.0, 'GANESHAN M'],
        [70, 230701521.0, 'JABARAJ E']], dtype=object)
```

[116]:
```
from sklearn.preprocessing import OneHotEncoder
oh = OneHotEncoder(sparse_output=False)
Country=oh.fit_transform(features[:,[0]])
Country
```

[116]:
```
array([[1., 0., 0., …, 0., 0., 0.],
       [0., 1., 0., …, 0., 0., 0.],
       [0., 0., 1., …, 0., 0., 0.],
       …,
       [0., 0., 0., …, 1., 0., 0.],
       [0., 0., 0., …, 0., 1., 0.],
       [0., 0., 0., …, 0., 0., 1.]])
```

[118]:
```
final_set=np.concatenate((Country,features[:,[1,2]]),axis=1)
final_set
```

[118]:
```
array([[1.0, 0.0, 0.0, …, 0.0, 230701001.0, 'AADITYA PARTHA
SARATHY'],
       [0.0, 1.0, 0.0, …, 0.0, 230701002.0, 'AAKASH V'],
       [0.0, 0.0, 1.0, …, 0.0, 230701003.0, 'ABHILASH G R'],
       …,
       [0.0, 0.0, 0.0, …, 0.0, 230701510.0, 'SARANYA M'],
       [0.0, 0.0, 0.0, …, 0.0, 230701514.0, 'GANESHAN M'],
       [0.0, 0.0, 0.0, …, 1.0, 230701521.0, 'JABARAJ E']],
      dtype=object)
```

[ ]:

[ ]:

13 LINEAR REGRESSION

[ ]:
```
#EX NO:11
#LINEAR REGRESSION 29/10/2024
#ARITRA GUPTA
#230701033
#CSE A
```

[4]:
```
import numpy as np
import pandas as pd
df=pd.read_csv('4i_salary_data.csv')
df
```

[4]:

	YearsExperience	Salary
0	1.1	39343.0
1	1.3	46205.0
2	1.5	37731.0
3	2.0	43525.0
4	2.2	39891.0
5	2.9	56642.0
6	3.0	60150.0
7	3.2	54445.0
8	3.2	64445.0
9	3.7	57189.0
10	3.9	63218.0
11	4.0	55794.0
12	4.0	56957.0
13	4.1	57081.0
14	4.5	61111.0
15	4.9	67938.0
16	5.1	66029.0
17	5.3	83088.0
18	5.9	81363.0
19	6.0	93940.0
20	6.8	91738.0
21	7.1	98273.0
22	7.9	101302.0
23	8.2	113812.0
24	8.7	109431.0
25	9.0	105582.0
26	9.5	116969.0
27	9.6	112635.0
28	10.3	122391.0
29	10.5	121872.0

[6]:
```
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    float64
dtypes:    float64(2)
memory  usage:  612.0
bytes
```

[8]:
```
df.dropna(inplace=True)
```

[10]:
```
df.describe()
```

[10]:
```
  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
```

[12]:
```
features=df.iloc[:,[0]].values
label=df.iloc[:,[1]].values
```

[14]:
```
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_state=0)
```

[16]:
```
from sklearn.linear_model import LinearRegression
model=LinearRegression()
model.fit(x_train,y_train)
```

[16]:
```
LinearRegression()
```

[18]:
```
model.score(x_train,y_train)
```

[18]:
```
 0.9411949620562126
```

[20]:
```
model.score(x_test,y_test)
```

[20]:
```
0.988169515729126
```

[22]:
```
import pickle
pickle.dump(model,open('SalaryPred.model','wb'))
```

[24]:
```
model=pickle.load(open('SalaryPred.model','rb'))
```

[26]:
```
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: 70
```

[30]:
```
print("Estimated Salary for {} years of experience is {}:
" .
↪format(yr_of_exp,Salary))
```

```
Estimated Salary for 70.0 years of experience is
                                    [[678660.35802167]]:
```

[ ]:
```

```

14 LOGISTIC REGRESSION

[ ]:
```
#EX NO:12
#LOGISTIC REGRESSION 05/11/2024
#ARITRA GUPTA
#230701033
#CSE A
```

[127]:
```
import numpy as np
import pandas as pd
df=pd.read_csv('4ii_Social_Network_Ads.csv')
df
```

[127]:

	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]

[129]:
```
df.head()
```

[129]:

	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

[131]:
```
features=df.iloc[:,[2,3]].values
label=df.iloc[:,4].values
features
```

```
[131]: 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],

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[   33, 28000],
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[   26, 72000],
[   27, 31000],
[   27, 17000],
[   33, 51000],
    35, 108000],
    30, 15000],
    28, 84000],
    23, 20000],
    25, 79000],
    27, 54000],
    30, 135000],
    31, 89000],
    24, 32000],
    18, 44000],
    29, 83000],
    35, 23000],
    27, 58000],
[   24, 55000],
[   23, 48000],
[   28, 79000],
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[   24, 27000],
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[   30, 80000],
[   39, 42000],
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[   30, 62000],
[   31, 118000],
[   24, 55000],
[   28, 85000],
[   26, 81000],
    35, 50000],
    22, 81000],
    30, 116000],
    26, 15000],
    29, 28000],
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     29, 83000],
     35, 44000],
     35, 25000],
     28, 123000],
     35, 73000],
     28, 37000],
     27, 88000],
     28, 59000],
[    32, 86000],
[   33, 149000],
[    19, 21000],
[    21, 72000],
[    26, 35000],
[    27, 89000],
[    26, 86000],
[    38, 80000],
[    39, 71000],
[    37, 71000],
[    38, 61000],
[    37, 55000],
[    42, 80000],
[    40, 57000],
[    35, 75000],
[    36, 52000],
[    40, 59000],
[    41, 59000],
[    36, 75000],
[    37, 72000],
[    40, 75000],
[    35, 53000],
[    41, 51000],
[    39, 61000],
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[   26, 84000],
[   31, 58000],
[   33, 31000],
[   30, 87000],
[   21, 68000],
[   28, 55000],
[   23, 63000],
    20, 82000],
    30, 107000],
    28, 59000],
    19, 25000],
    19, 85000],
    18, 68000],
    35, 59000],
    30, 89000],
    34, 25000],
    24, 89000],
    27, 96000],
    41, 30000],
    29, 61000],
[   20, 74000],
[   26, 15000],
[   41, 45000],
[   31, 76000],
[   36, 50000],
[   40, 47000],
[   31, 15000],
[   46, 59000],
[   29, 75000],
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[   26, 30000],
[   32, 135000],
[   32, 100000],
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[   37, 33000],
[   35, 38000],
[   33, 69000],
[   18, 86000],
[   22, 55000],
[   35, 71000],
[   29, 148000],
[   29, 47000],
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[   26, 118000],
[   34, 43000],
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[   35, 47000],
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[   24, 23000],
[   31, 34000],
[   26, 16000],
[   31, 71000],
[   32, 117000],
    33, 43000],
    33, 60000],
    31, 66000],
    20, 82000],
    33, 41000],
    35, 72000],
    28, 32000],
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     24, 84000],
     19, 26000],
     29, 43000],
     19, 70000],
     28, 89000],
     34, 43000],
[    30, 79000],
[    20, 36000],
[    26, 80000],
[    35, 22000],
[    35, 39000],
[    49, 74000],
[    39, 134000],
[    41, 71000],
[    58, 101000],
[    47, 47000],
[    55, 130000],
[    52, 114000],
[    40, 142000],
[    46, 22000],
[    48, 96000],
[    52, 150000],
[    59, 42000],
[    35, 58000],
[    47, 43000],
[    60, 108000],
[    49, 65000],
[    40, 78000],
[    46, 96000],
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[   36, 33000],
[  49, 36000]], dtype=int64)
```

[133]:

```
label
```

[133]:
```
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,
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       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,
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       1, 0,
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       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)
```

[135]:
```
from sklearn.model_selection import
train_test_split from sklearn.linear_model
import LogisticRegression
```

[141]:
```
for i in range(1,401):
    x_train,x_test,y_train,y_test=train_test_split(features,label,te
    st_size=0.
↪2,random_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_te
    st) if test_score>train_score:
        print("Test {} Train{} Random State {}".
↪format(test_score,train_score,i))
```

```
Test 0.9 Train0.840625 Random State 4
Test 0.8625 Train0.85 Random State 5
Test 0.8625 Train0.859375 Random State 6
Test 0.8875 Train0.8375 Random State 7
Test 0.8625 Train0.8375 Random State 9
Test 0.9 Train0.840625 Random State 10
Test 0.8625 Train0.85625 Random State 14
```

```
Test 0.85 Train0.84375 Random State 15
Test 0.8625 Train0.85625 Random State 16
Test 0.875 Train0.834375 Random State 18
Test 0.85 Train0.84375 Random State 19
Test 0.875 Train0.84375 Random State 20
Test 0.8625 Train0.834375 Random State 21
Test 0.875 Train0.840625 Random State 22
Test 0.875 Train0.840625 Random State 24
Test 0.85 Train0.834375 Random State 26
Test 0.85 Train0.840625 Random State 27
Test 0.8625 Train0.834375 Random State 30
Test 0.8625 Train0.85625 Random State 31
Test 0.875 Train0.853125 Random State 32
Test 0.8625 Train0.84375 Random State 33
Test 0.875 Train0.83125 Random State 35
Test 0.8625 Train0.853125 Random State 36
Test 0.8875 Train0.840625 Random State 38
Test 0.875 Train0.8375 Random State 39
Test 0.8875 Train0.8375 Random State 42
Test 0.875 Train0.846875 Random State 46
Test 0.9125 Train0.83125 Random State 47
Test 0.875 Train0.83125 Random State 51
Test 0.9 Train0.84375 Random State 54
Test 0.85 Train0.84375 Random State 57
Test 0.875 Train0.84375 Random State 58
Test 0.925 Train0.8375 Random State 61
Test 0.8875 Train0.834375 Random State 65
Test 0.8875 Train0.840625 Random State 68
Test 0.9 Train0.83125 Random State 72
Test 0.8875 Train0.8375 Random State 75
Test 0.925 Train0.825 Random State 76
Test 0.8625 Train0.840625 Random State 77
Test 0.8625 Train0.859375 Random State 81
Test 0.875 Train0.8375 Random State 82
Test 0.8875 Train0.8375 Random State 83
Test 0.8625 Train0.853125 Random State 84
Test 0.8625 Train0.840625 Random State 85
Test 0.8625 Train0.840625 Random State 87
Test 0.875 Train0.846875 Random State 88
Test 0.9125 Train0.8375 Random State 90
Test 0.8625 Train0.85 Random State 95
Test 0.875 Train0.85 Random State 99
Test 0.85 Train0.840625 Random State 101
Test 0.85 Train0.840625 Random State 102
Test 0.9 Train0.825 Random State 106
Test 0.8625 Train0.840625 Random State 107
```

Test 0.85 Train0.834375 Random State 109
Test 0.85 Train0.840625 Random State 111
Test 0.9125 Train0.840625 Random State 112
Test 0.8625 Train0.85 Random State 115
Test 0.8625 Train0.840625 Random State
116 Test 0.875 Train0.834375 Random
State 119
Test 0.9125 Train0.828125 Random State 120
Test 0.8625 Train0.859375 Random State 125
Test 0.85 Train0.846875 Random State 128
Test 0.875 Train0.85 Random State 130
Test 0.9 Train0.84375 Random State 133
Test 0.925 Train0.834375 Random State 134
Test 0.8625 Train0.85 Random State 135
Test 0.875 Train0.83125 Random State 138
Test 0.8625 Train0.85 Random State 141
Test 0.85 Train0.846875 Random State 143
Test 0.85 Train0.846875 Random State 146
Test 0.85 Train0.84375 Random State
147 Test 0.8625 Train0.85 Random
State 148
Test 0.875 Train0.8375 Random State 150
Test 0.8875 Train0.83125 Random State 151
Test 0.925 Train0.84375 Random State 152
Test 0.85 Train0.840625 Random State 153
Test 0.9 Train0.84375 Random State 154
Test 0.9 Train0.840625 Random State 155
Test 0.8875 Train0.846875 Random State 156
Test 0.8875 Train0.834375 Random State 158
Test 0.875 Train0.828125 Random State 159
Test 0.9 Train0.83125 Random State 161
Test 0.85 Train0.8375 Random State 163
Test 0.875 Train0.83125 Random State 164
Test 0.8625 Train0.85 Random State 169
Test 0.875 Train0.840625 Random State 171
Test 0.85 Train0.840625 Random State 172
Test 0.9 Train0.825 Random State 180
Test 0.85 Train0.834375 Random State 184
Test 0.925 Train0.821875 Random State 186
Test 0.9 Train0.83125 Random State 193
Test 0.8625 Train0.85 Random State 195
Test 0.8625 Train0.840625 Random State 196
Test 0.8625 Train0.8375 Random State 197
Test 0.875 Train0.840625 Random State
198 Test 0.8875 Train0.8375 Random
State 199

Test 0.8875 Train0.84375 Random State 200
Test 0.8625 Train0.8375 Random State 202
Test 0.8625 Train0.840625 Random State
203 Test 0.8875 Train0.83125 Random
State 206
Test 0.8625 Train0.834375 Random State 211
Test 0.85 Train0.84375 Random State 212
Test 0.8625 Train0.834375 Random State 214
Test 0.875 Train0.83125 Random State 217
Test 0.9625 Train0.81875 Random State 220
Test 0.875 Train0.84375 Random State 221
Test 0.85 Train0.840625 Random State 222
Test 0.9 Train0.84375 Random State 223
Test 0.8625 Train0.853125 Random State 227
Test 0.8625 Train0.834375 Random State 228
Test 0.9 Train0.840625 Random State 229
Test 0.85 Train0.84375 Random State 232
Test 0.875 Train0.846875 Random State 233
Test 0.9125 Train0.840625 Random State 234
Test 0.8625 Train0.840625 Random State 235
Test 0.85 Train0.846875 Random State 236
Test 0.875 Train0.846875 Random State 239
Test 0.85 Train0.84375 Random State
241 Test 0.8875 Train0.85 Random
State 242
Test 0.8875 Train0.825 Random State 243
Test 0.875 Train0.846875 Random State 244
Test 0.875 Train0.840625 Random State 245
Test 0.875 Train0.846875 Random State 246
Test 0.8625 Train0.859375 Random State 247
Test 0.8875 Train0.84375 Random State 248
Test 0.8625 Train0.85 Random State 250
Test 0.875 Train0.83125 Random State 251
Test 0.8875 Train0.84375 Random State 252
Test 0.8625 Train0.846875 Random State 255
Test 0.9 Train0.840625 Random State 257 Test 0.8625 Train0.85625
Random State 260
Test 0.8625 Train0.840625 Random State 266
Test 0.8625 Train0.8375 Random State 268
Test 0.875 Train0.840625 Random State 275
Test 0.8625 Train0.85 Random State 276
Test 0.925 Train0.8375 Random State 277
Test 0.875 Train0.846875 Random State 282
Test 0.85 Train0.846875 Random State 283
Test 0.85 Train0.84375 Random State 285
Test 0.9125 Train0.834375 Random State 286

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Test 0.85 Train0.840625 Random State 290
Test 0.85 Train0.840625 Random State 291
Test 0.85 Train0.846875 Random State 292
Test 0.8625 Train0.8375 Random State 294
Test 0.8875 Train0.828125 Random State 297
Test 0.8625 Train0.834375 Random State 300
Test 0.8625 Train0.85 Random State 301
Test 0.8875 Train0.85 Random State 302
Test 0.875 Train0.846875 Random State 303
Test 0.8625 Train0.834375 Random State 305
Test 0.9125 Train0.8375 Random State 306
Test 0.875 Train0.846875 Random State 308
Test 0.9 Train0.84375 Random State 311
Test 0.8625 Train0.834375 Random State 313
Test 0.9125 Train0.834375 Random State 314
Test 0.875 Train0.8375 Random State 315
Test 0.9 Train0.846875 Random State 317
Test 0.9125 Train0.821875 Random State 319
Test 0.8625 Train0.85 Random State 321
Test 0.9125 Train0.828125 Random State 322
Test 0.85 Train0.846875 Random State 328
Test 0.85 Train0.8375 Random State 332
Test 0.8875 Train0.853125 Random State 336
Test 0.85 Train0.8375 Random State 337
Test 0.875 Train0.840625 Random State 343
Test 0.8625 Train0.84375 Random State 346
Test 0.8875 Train0.83125 Random State 351
Test 0.8625 Train0.85 Random State 352
Test 0.95 Train0.81875 Random State 354
Test 0.8625 Train0.85 Random State 356
Test 0.9125 Train0.840625 Random State 357
Test 0.8625 Train0.8375 Random State 358
Test 0.85 Train0.840625 Random State 362
Test 0.9 Train0.84375 Random State 363
Test 0.8625 Train0.853125 Random State 364
Test 0.9375 Train0.821875 Random State 366
Test 0.9125 Train0.840625 Random State 369
Test 0.8625 Train0.853125 Random State 371 Test 0.925 Train0.834375
Random State 376
Test 0.9125 Train0.828125 Random State 377
Test 0.8875 Train0.85 Random State 378
Test 0.8875 Train0.85 Random State 379
Test 0.8625 Train0.840625 Random State 382
Test 0.8625 Train0.859375 Random State 386
Test 0.85 Train0.8375 Random State 387
Test 0.875 Train0.828125 Random State 388
```

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Test 0.85 Train0.84375 Random State 394
Test 0.8625 Train0.8375 Random State 395
Test 0.9 Train0.84375 Random State 397
Test 0.8625 Train0.84375 Random State 400
```

[143]:
```
x_train,x_test,y_train,y_test=train_test_split(features,label,test_size=0
.2,␣
 ↪random_state=354)
finalModel=LogisticRegression()
finalModel.fit(x_train,y_train)
```

[143]: LogisticRegression()

[145]:
```
print(finalModel.score(x_train,y_train))
print(finalModel.score(x_test,y_test))
```

```
0.81875
0.95
```

[147]:
```
from sklearn.metrics import classification_report
print(classification_report(label,finalModel.predict(features)))
```

```
              precision    recall  f1-      support
                           score

           0       0.85      0.91      0.88      257
           1       0.82      0.72      0.77      143

    accuracy                           0.84       400
   macro avg       0.84      0.82      0.83      400
weighted           0.84      0.84      0.84      400
avg
```

[ ]: