1ABASICEXPERIMENTS

November 20, 2024

[ ]:
```
#EX NO:1A
#BASIC PRACTICE EXPERIMENTS 30/07/2024
#DANIEL LEVE MANICKAM D A
#230701060
#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]:

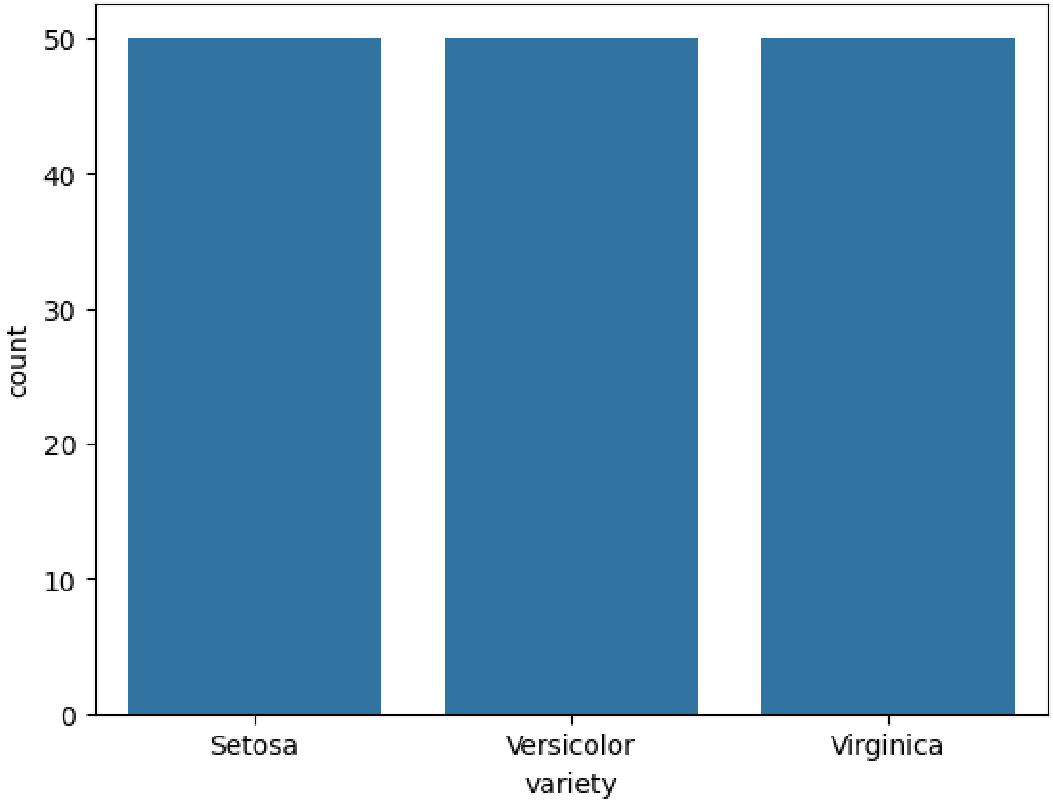
```
data.value_counts('variety')
```

[328]:

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

[330]:

```
sns.countplot(x='variety',data=data,)
plt.show()
```



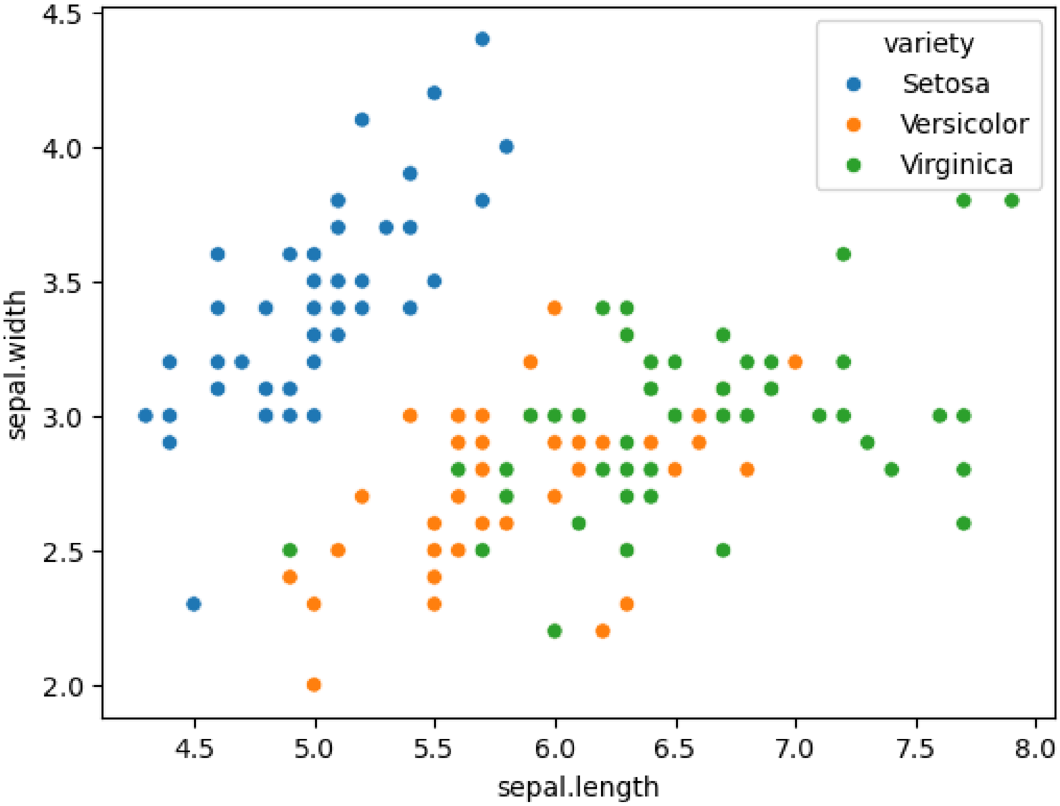
[332]:
```
dummies=pd.get_dummies(data.variety)
FinalDataset=pd.concat([pd.get_dummies(data.variety),data.iloc[:
  ↪,[0,1,2,3]]],axis=1)
FinalDataset.head()
```

[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   

   petal.width  
0          0.2  
1          0.2  
2          0.2  
3          0.2  
4          0.2  
```

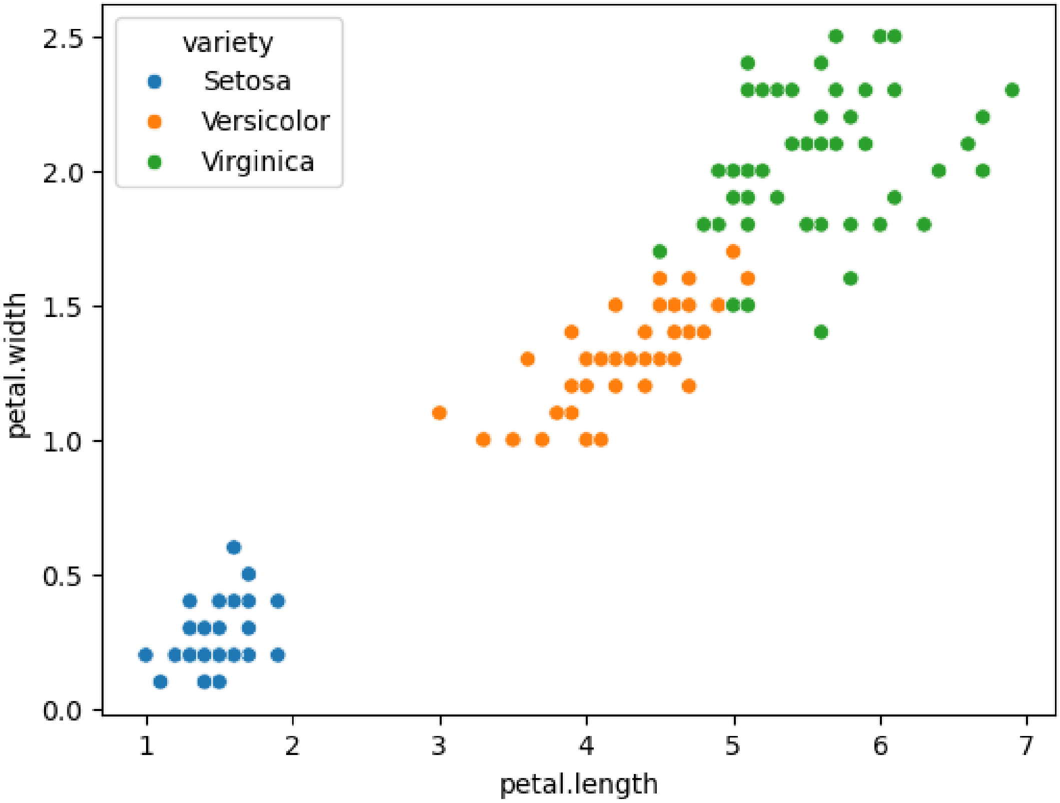
[340]:
```
sns.scatterplot(x='sepal.length',y='sepal.width',hue='variety',data=data)
```

```
[340]: <Axes: xlabel='sepal.length', ylabel='sepal.width'>
```

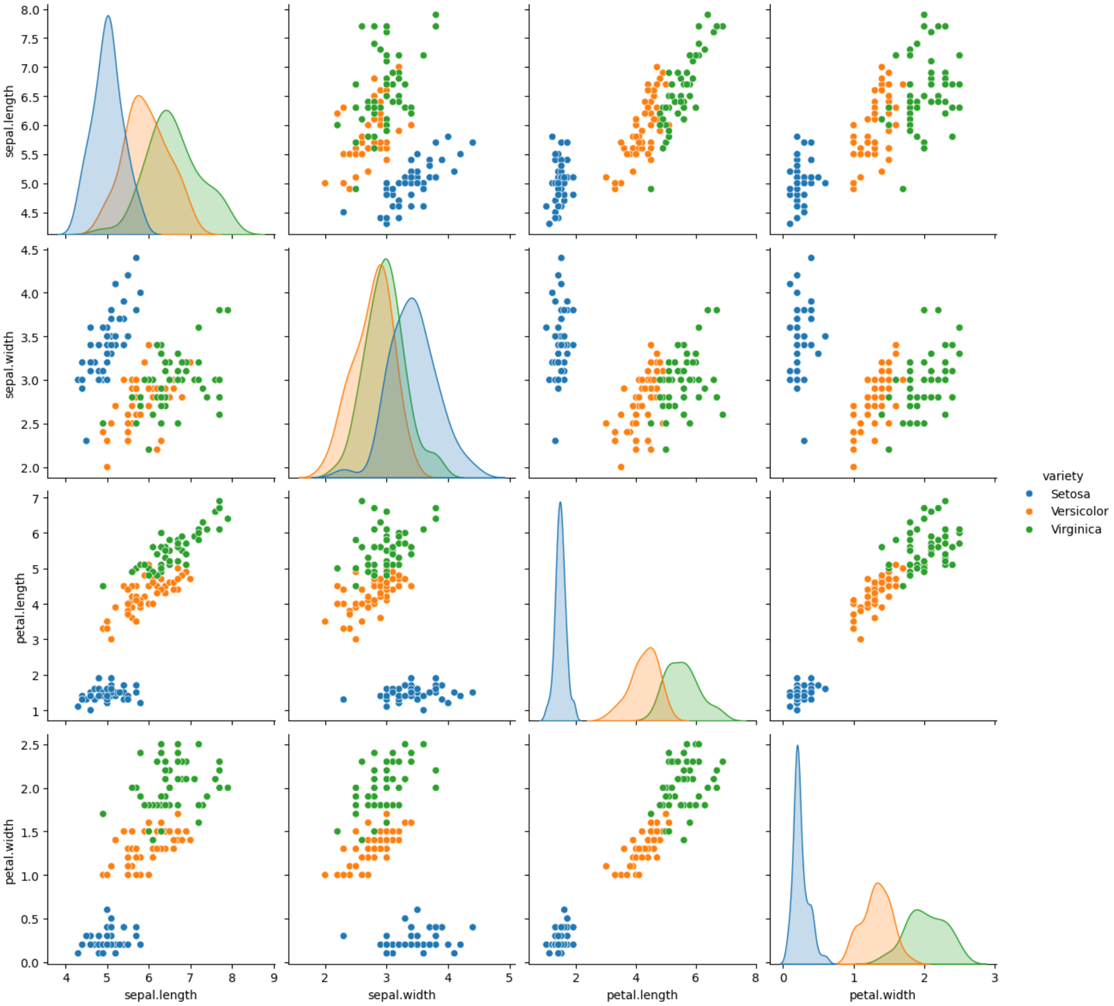


```
[342]: sns.scatterplot(x='petal.length',y='petal.width',hue='variety',data=data,)
```

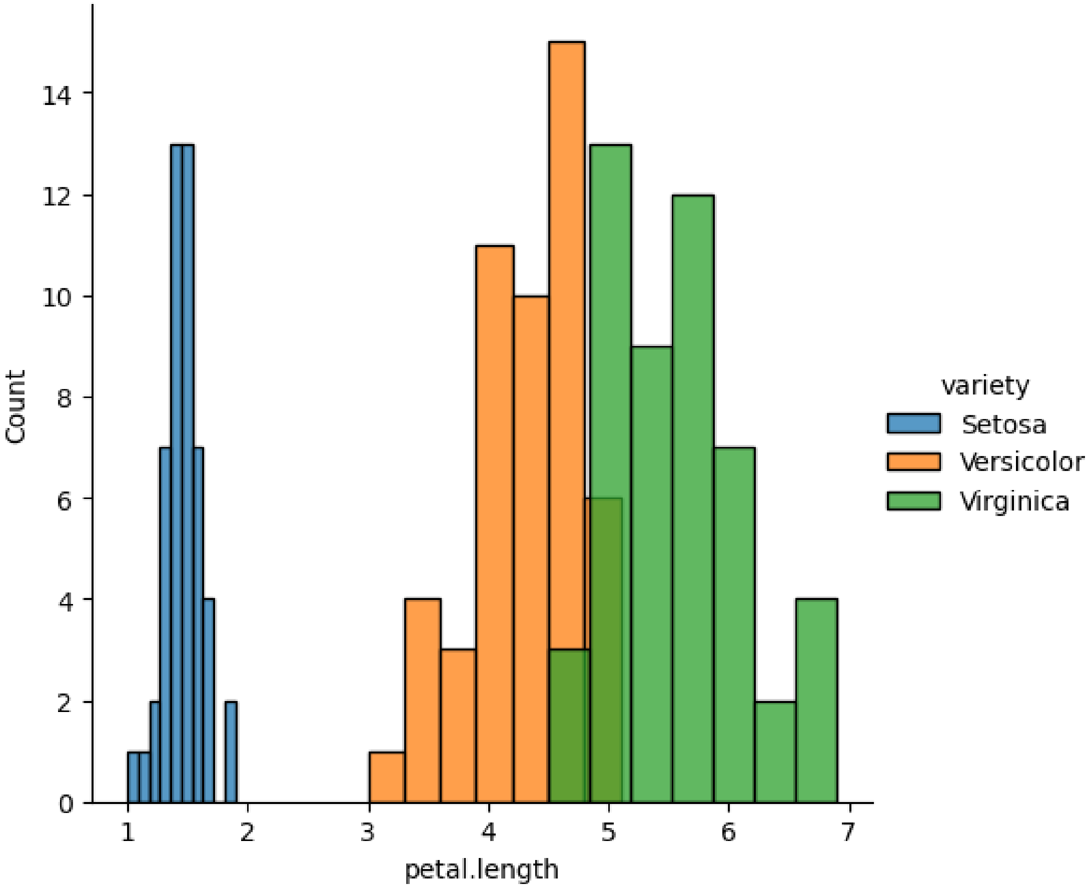
```
[342]: <Axes: xlabel='petal.length', ylabel='petal.width'>
```



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

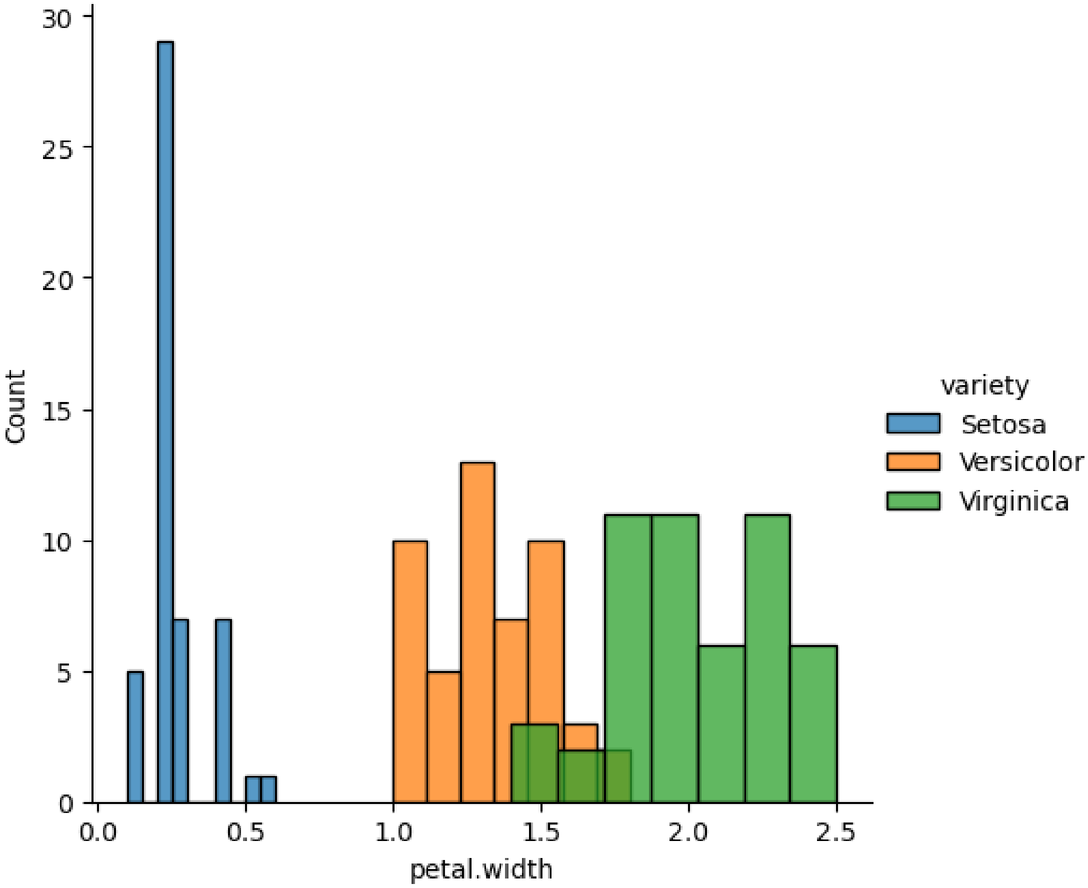


```
[351]: sns.FacetGrid(data,hue='variety',height=5).map(sns.histplot,'petal.length').
         ↪add_legend();
       plt.show();
```



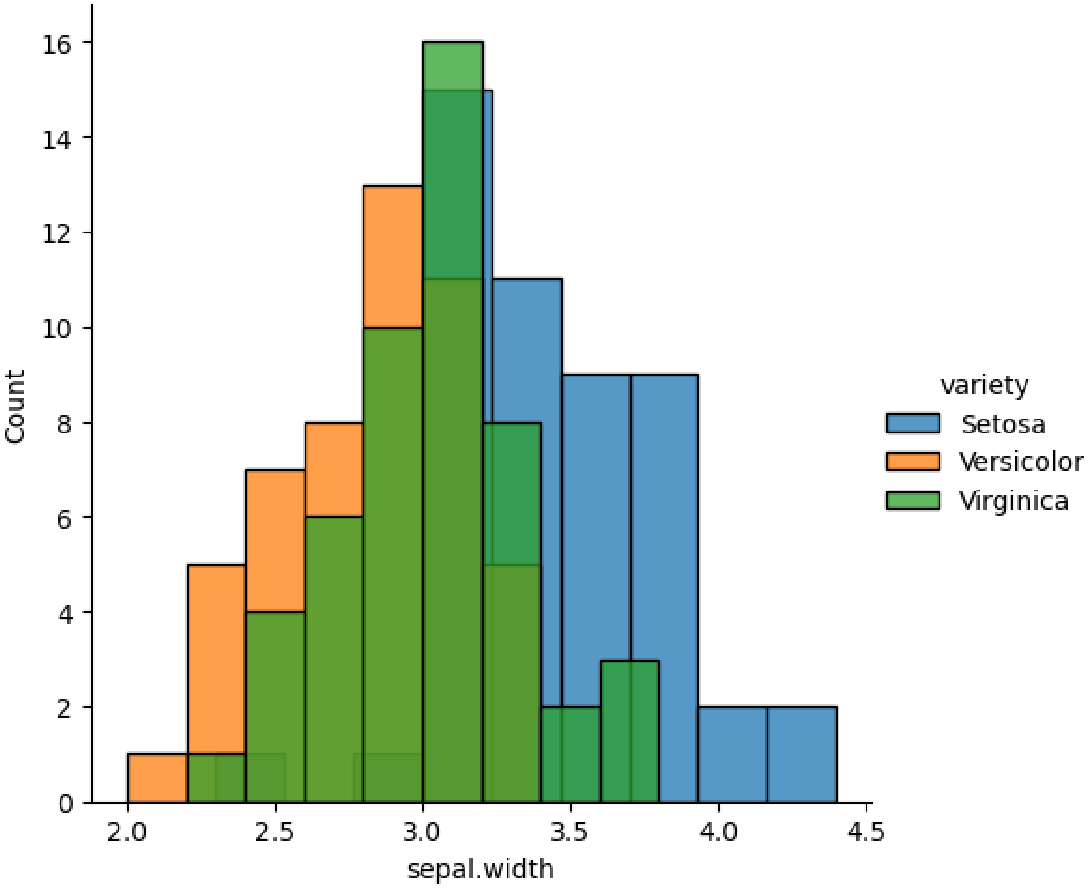
[353]:

```
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

```
[ ]:
```

1BNUMPY

November 20, 2024

```
[ ]: #EX NO:1B
     #NUMPY 06/08/2024
     #DANIEL LEVE MANICKAM D A
     #230701060
     #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]])
```

```
[ ]:
```

1BPANDAS

November 20, 2024

[ ]:

```
#EX NO:4
#PANDAS 06/08/2024
#DANIEL LEVE MANICKAM D A
#230701060
#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 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>
```

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

[37]:
```
<bound method Series.std of 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>
```

[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)
```

```
[ ]:
```

```
[ ]:
```

EXNO2OUTLIERDETECTION

November 20, 2024

```
[ ]: #EX NO:2
     #OUTLIER DETECTION 30/07/2024
     #DANIEL LEVE MANICKAM D A
     #230701060
     #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)
```

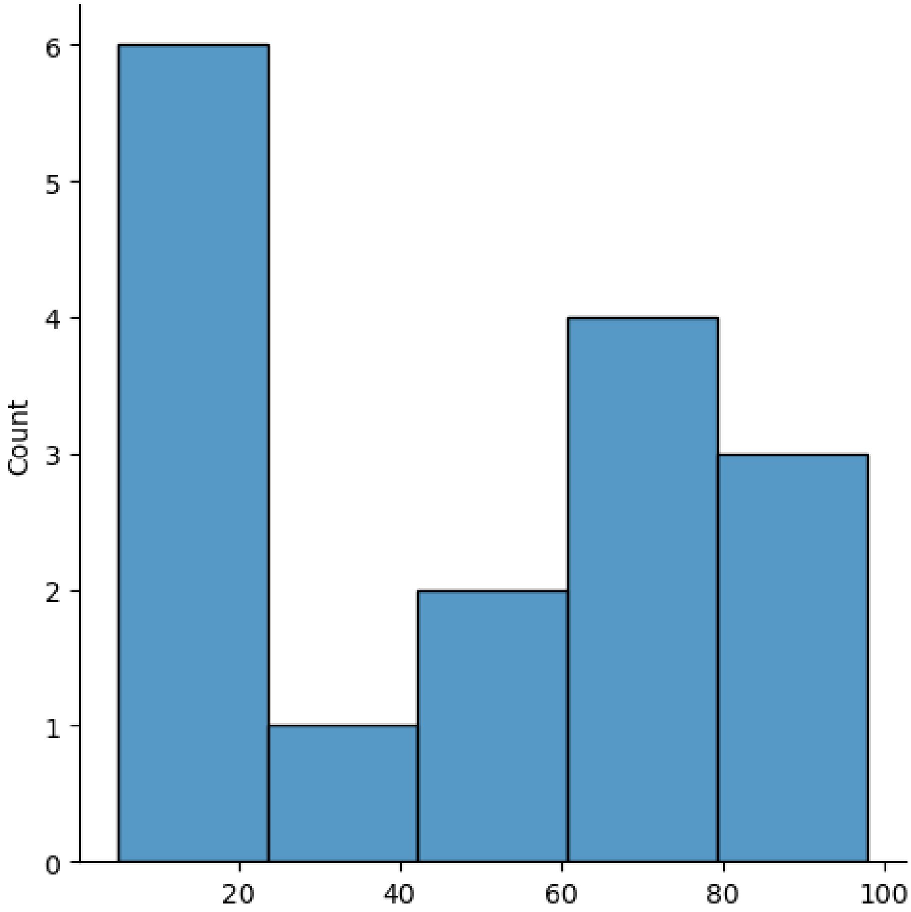
```
[8]: 71.5
```

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

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

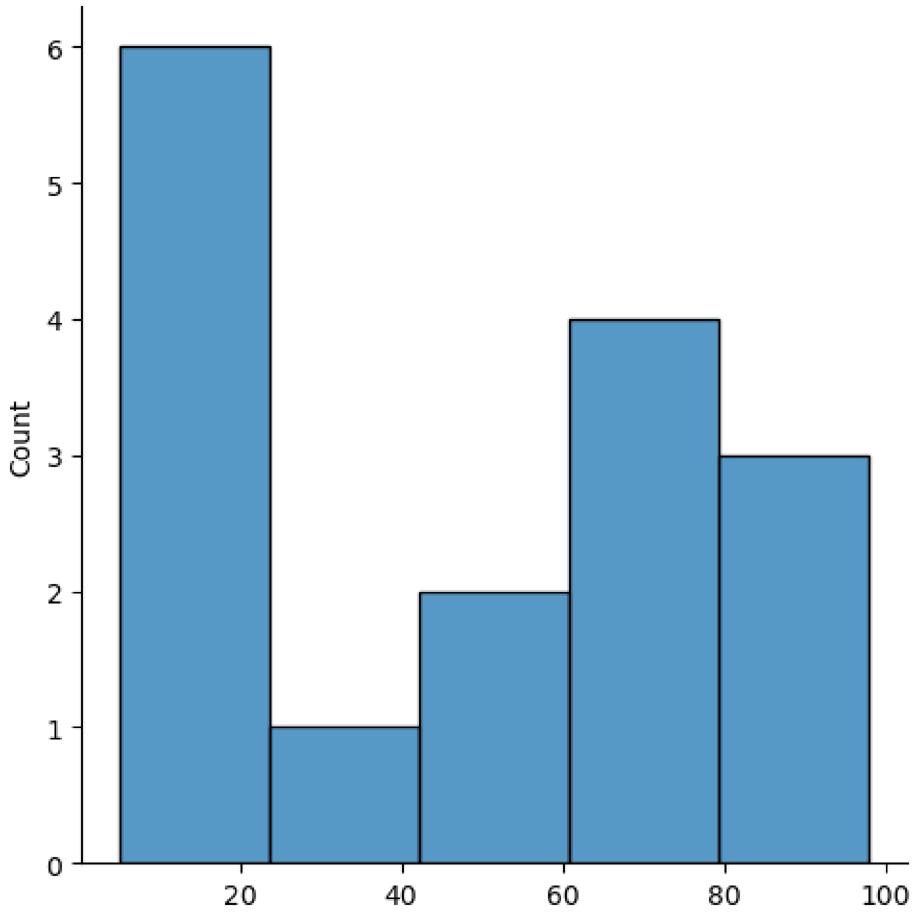


[16]:
```
new_array=array[(array>lr) & (array<ur)]
new_array
```

[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])
```

[ ]:

```

```

EXNO3MISSINGANDINAPPROPRIATEDATA

November 20, 2024

[ ]:

```
#EX NO:3
#MISSING AND INAPPROPRIATE DATA 20/08/2024
#DANIEL LEVE MANICKAM D A
#230701060
#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  \
     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
```

[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  \
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
```

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

```
[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]: 0         Ibis
      1    LemonTree
      2       RedFox
      3    LemonTree
      4         Ibis
      5         Ibis
      6       RedFox
      7    LemonTree
```

```
8         Ibis
9       RedFox
Name: Hotel, dtype: object
```

# EXNO4DATAPREPROCESSING

November 20, 2024

[ ]:

```
#EX NO:4
#DATA PREPROCESSING 27/08/2024
#DANIEL LEVE MANICKAM D A
#230701060
#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  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]
```

[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
```

[ ]:

```

```

EXNO5EDAANALYSIS

November 20, 2024

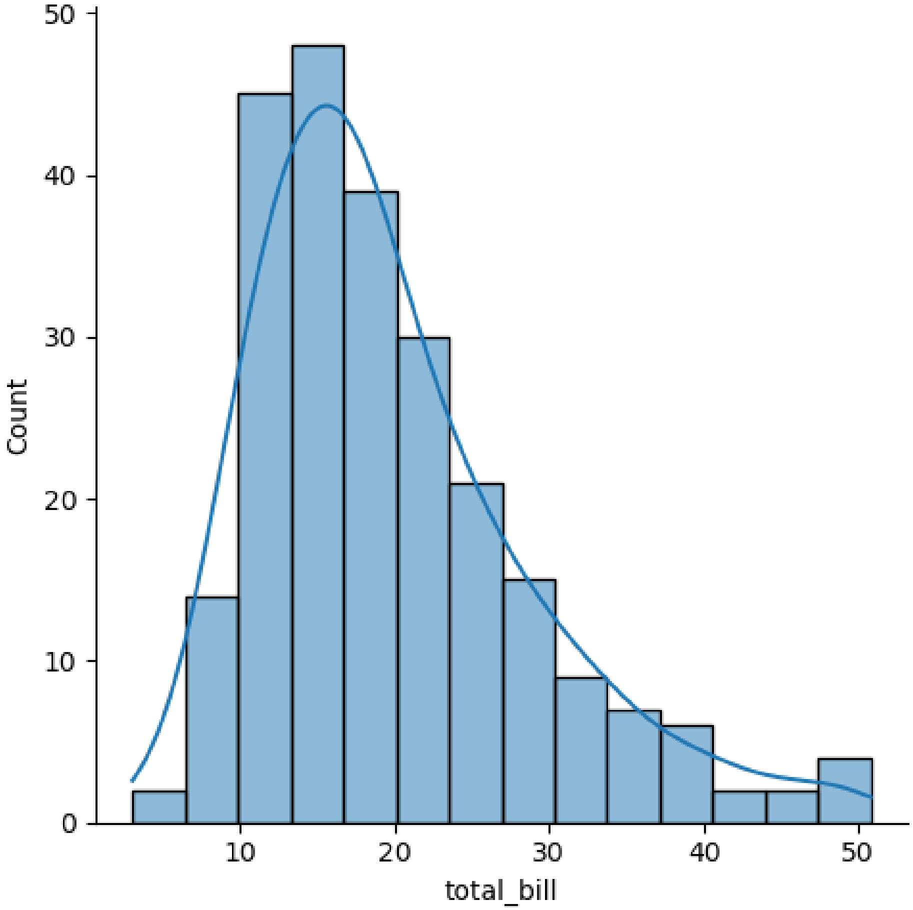
```
[ ]: #EX NO:5
     #EDA,QUANTITATIVE AND QUALITATIVE DATA 03/09/2024
     #DANIEL LEVE MANICKAM D A
     #230701060
     #CSE A
```

```
[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
```

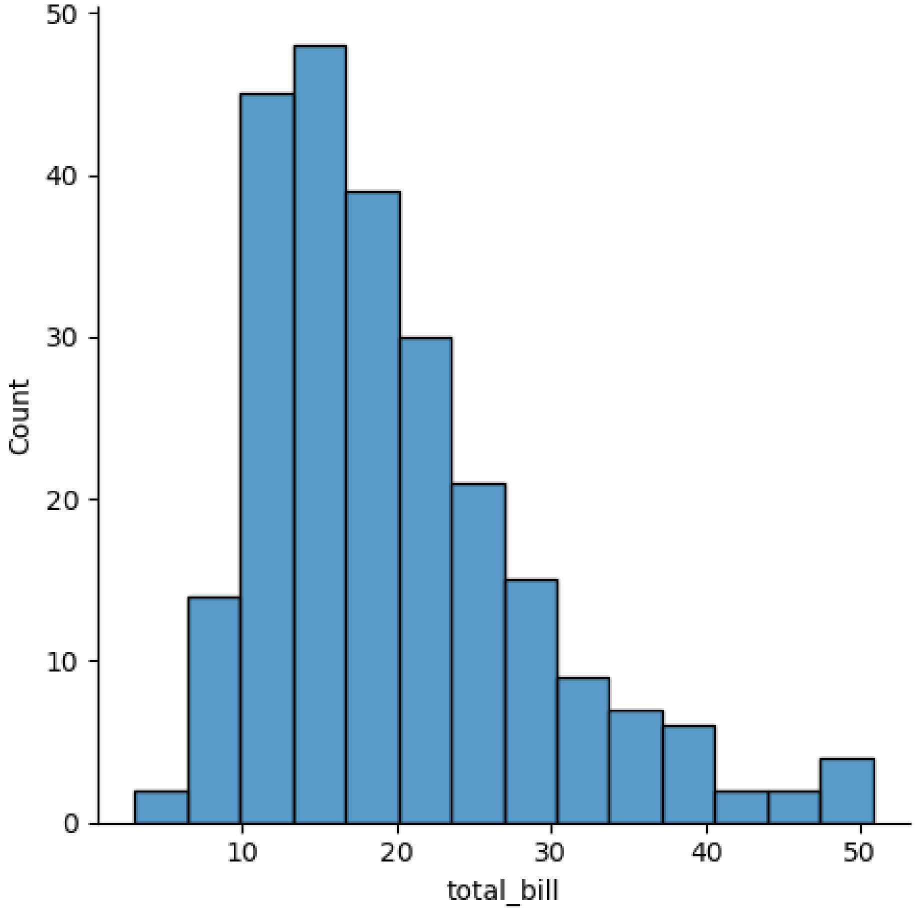
```
[65]: sns.displot(tips.total_bill,kde=True)
```

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



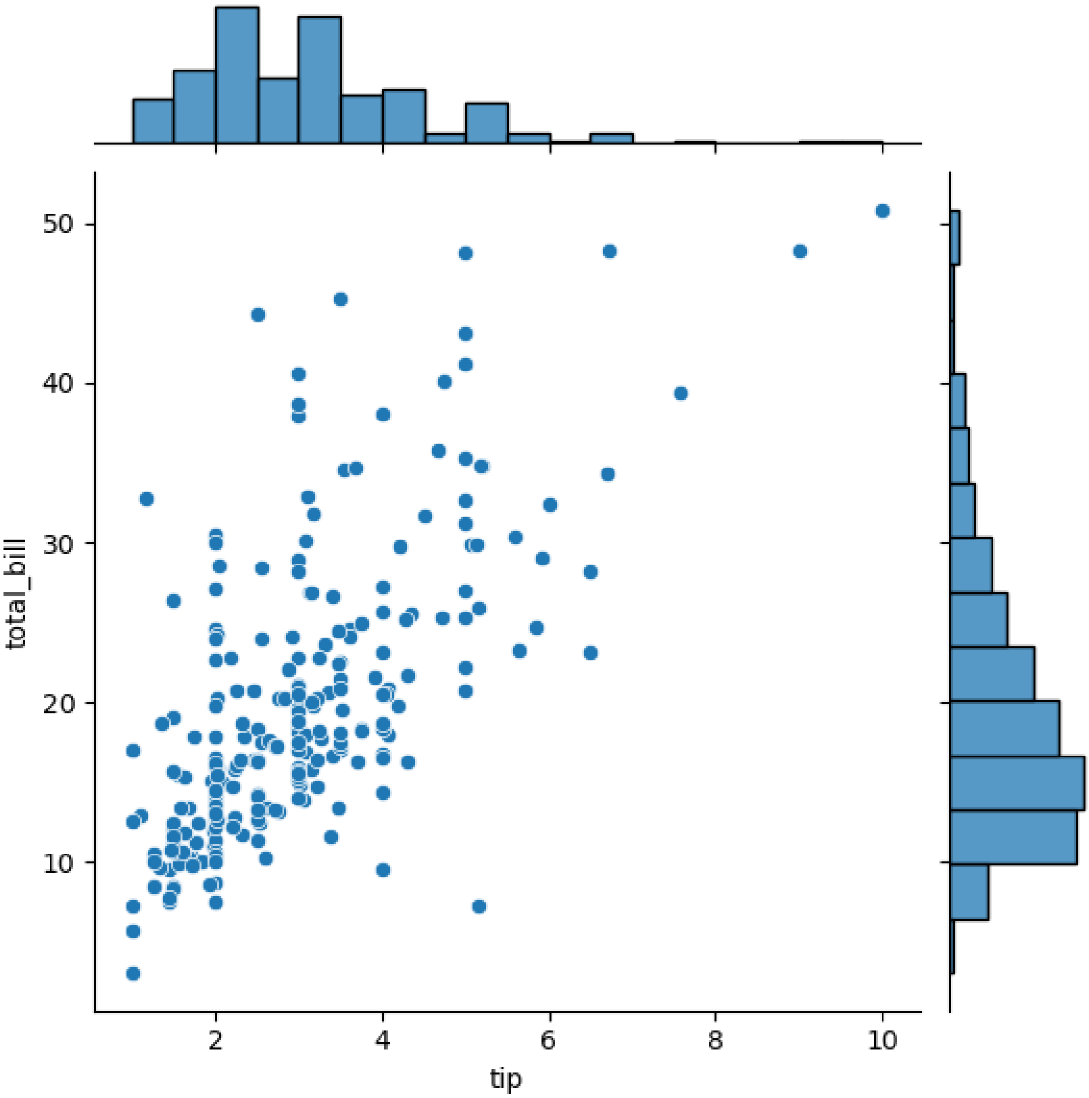
[67]:
```
sns.displot(tips.total_bill,kde=False)
```

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



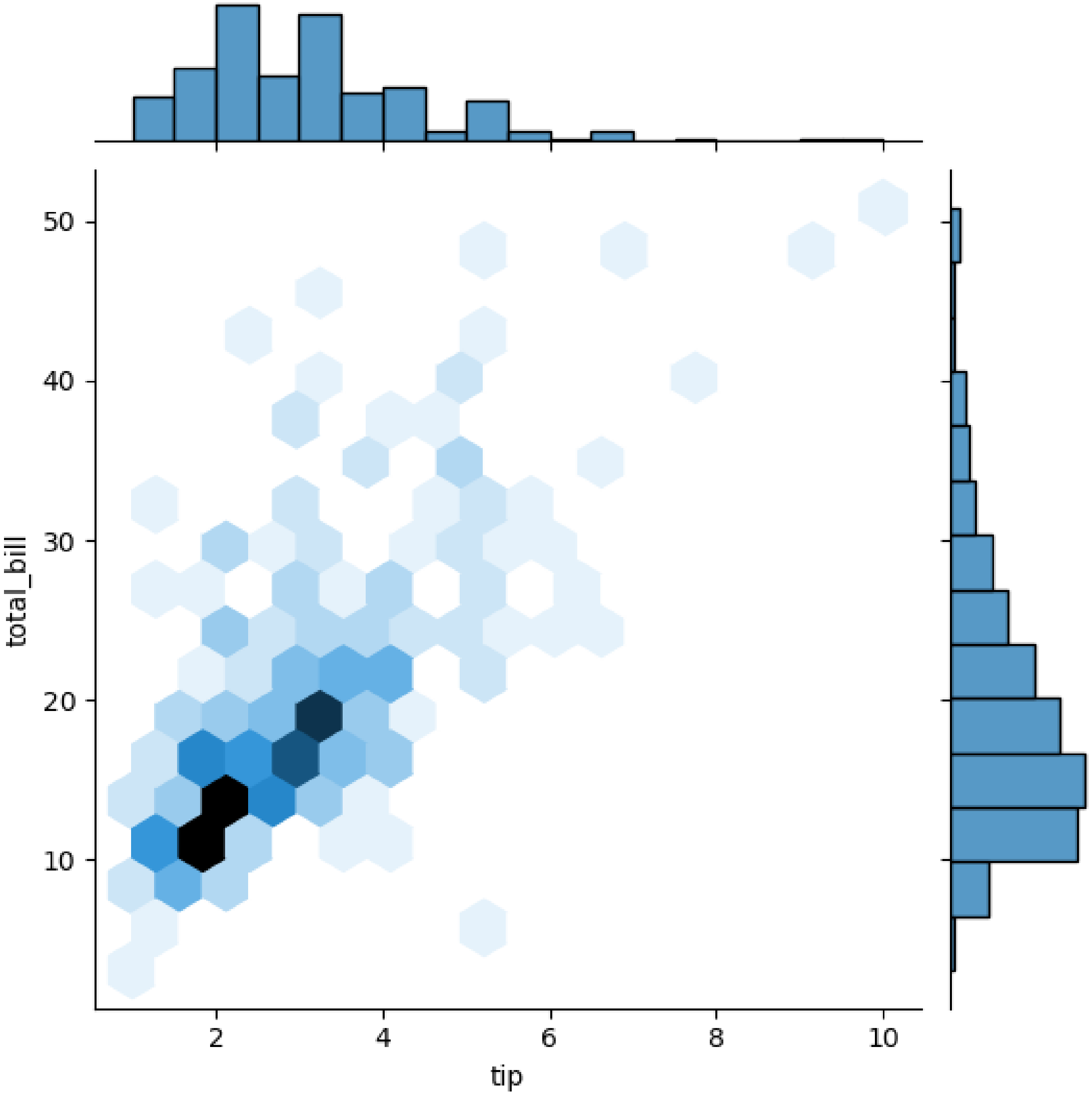
```
[69]: sns.jointplot(x=tips.tip,y=tips.total_bill)
```

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



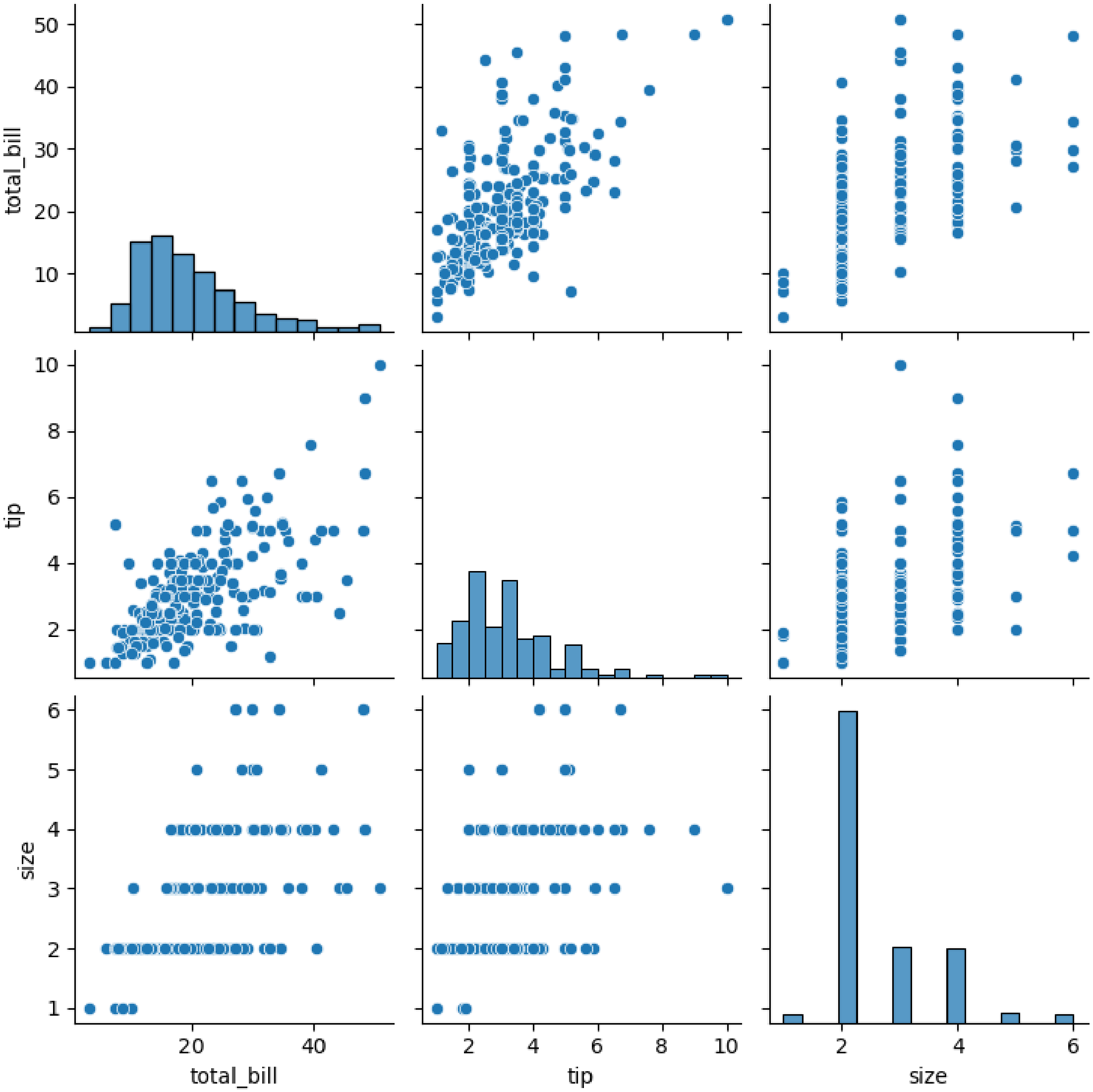
```
[71]: sns.jointplot(x=tips.tip,y=tips.total_bill,kind="hex")
```

```
[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
```

[ ]:
```

```

EXNO6RANDOMSAMPLING

November 20, 2024

[ ]:
```
#EX NO:6
#RANDOM SAMPLING 10/09/2024
#DANIEL LEVE MANICKAM D A
#230701060
#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] = []
```

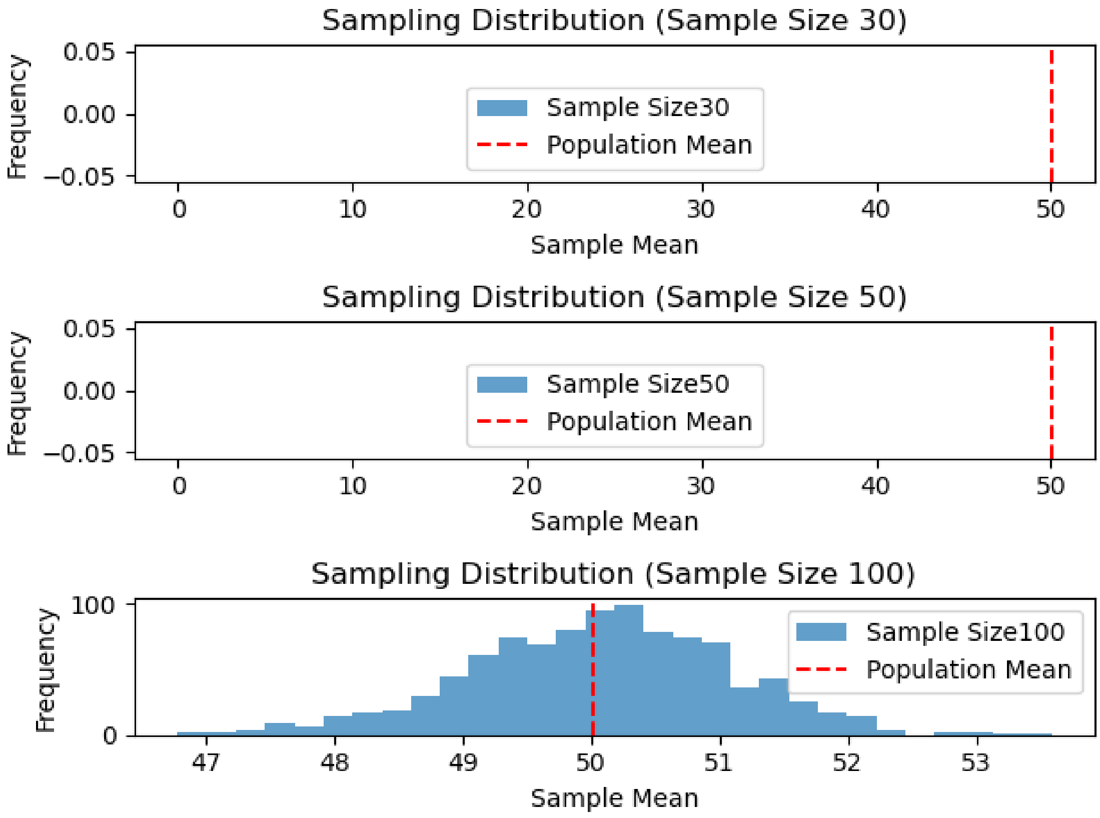
[188]:
```
for _ in range(num_samples):
    sample = np.random.choice(population, size=size, replace=False)
    sample_means[size].append(np.mean(sample))
```

[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()
```



[ ]:

[ ]:

EXNO7ZTEST

November 20, 2024

[ ]:

```
#EX NO:7
#Z-TEST 10/09/2024
#DANIEL LEVE MANICKAM D A
#230701060
#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.
```

[ ]:

[ ]:

EXNO8TTEST

November 20, 2024

[ ]:

```
#EX NO:8
#T-TEST 08/10/2024
#DANIEL LEVE MANICKAM D A
#230701060
#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.
```

[ ]:

```
```

[ ]:

```
```

# EXNO9ANOVATEST

November 20, 2024

```
[ ]: #EX NO:9
     #ANOVA-TEST 08/10/2024
     #DANIEL LEVE MANICKAM D A
     #230701060
     #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
---------------------------------------------------
```

[ ]:
```

```

EX10FEATURESCALING

November 20, 2024

```
[ ]: #EX NO:10
     #FEATURE SCALING 22/10/2024
     #DANIEL LEVE MANICKAM D A
     #230701060
     #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  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]
```

```
[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  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]
```

```
[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)
```

```
[ ]:
```

```
[ ]:
```

EXNO11LINEARREGRESSION

November 20, 2024

```
[ ]: #EX NO:11
     #LINEAR REGRESSION 29/10/2024
     #DANIEL LEVE MANICKAM D A
     #230701060
     #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]]:
```

```
[ ]:
```

EXNO12LOGISTICREGRESSION

November 20, 2024

[ ]:
```
#EX NO:12
#LOGISTIC REGRESSION 05/11/2024
#DANIEL LEVE MANICKAM D A
#230701060
#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],
              [    33,  28000],
              [    30,  49000],
              [    26,  72000],
              [    27,  31000],
              [    27,  17000],
              [    33,  51000],
              [    35, 108000],
              [    30,  15000],
              [    28,  84000],
              [    23,  20000],
              [    25,  79000],
              [    27,  54000],
              [    30, 135000],
              [    31,  89000],
              [    24,  32000],
              [    18,  44000],
              [    29,  83000],
              [    35,  23000],
              [    27,  58000],
              [    24,  55000],
              [    23,  48000],
              [    28,  79000],
              [    22,  18000],
              [    32, 117000],
              [    27,  20000],
              [    25,  87000],
              [    23,  66000],
              [    32, 120000],
              [    59,  83000],
              [    24,  58000],
              [    24,  19000],
              [    23,  82000],
              [    22,  63000],
              [    31,  68000],
              [    25,  80000],
              [    24,  27000],
              [    20,  23000],
              [    33, 113000],
              [    32,  18000],
              [    34, 112000],
              [    18,  52000],
              [    22,  27000],
              [    28,  87000],
              [    26,  17000],
              [    30,  80000],
              [    39,  42000],
              [    20,  49000],
              [    35,  88000],
              [    30,  62000],
              [    31, 118000],
              [    24,  55000],
              [    28,  85000],
              [    26,  81000],
              [    35,  50000],
              [    22,  81000],
              [    30, 116000],
              [    26,  15000],
              [    29,  28000],
              [    29,  83000],
              [    35,  44000],
              [    35,  25000],
              [    28, 123000],
              [    35,  73000],
              [    28,  37000],
              [    27,  88000],
              [    28,  59000],
              [    32,  86000],
              [    33, 149000],
              [    19,  21000],
              [    21,  72000],
              [    26,  35000],
              [    27,  89000],
              [    26,  86000],
              [    38,  80000],
              [    39,  71000],
              [    37,  71000],
              [    38,  61000],
              [    37,  55000],
              [    42,  80000],
              [    40,  57000],
              [    35,  75000],
              [    36,  52000],
              [    40,  59000],
              [    41,  59000],
              [    36,  75000],
              [    37,  72000],
              [    40,  75000],
              [    35,  53000],
              [    41,  51000],
              [    39,  61000],
              [    42,  65000],
              [    26,  32000],
              [    30,  17000],
              [    26,  84000],
              [    31,  58000],
              [    33,  31000],
              [    30,  87000],
              [    21,  68000],
              [    28,  55000],
              [    23,  63000],
              [    20,  82000],
              [    30, 107000],
              [    28,  59000],
              [    19,  25000],
              [    19,  85000],
              [    18,  68000],
              [    35,  59000],
              [    30,  89000],
              [    34,  25000],
              [    24,  89000],
              [    27,  96000],
              [    41,  30000],
              [    29,  61000],
              [    20,  74000],
              [    26,  15000],
              [    41,  45000],
              [    31,  76000],
              [    36,  50000],
              [    40,  47000],
              [    31,  15000],
              [    46,  59000],
              [    29,  75000],
              [    26,  30000],
              [    32, 135000],
              [    32, 100000],
              [    25,  90000],
              [    37,  33000],
              [    35,  38000],
              [    33,  69000],
              [    18,  86000],
              [    22,  55000],
              [    35,  71000],
              [    29, 148000],
              [    29,  47000],
              [    21,  88000],
              [    34, 115000],
              [    26, 118000],
              [    34,  43000],
              [    34,  72000],
              [    23,  28000],
              [    35,  47000],
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```

[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,
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       0, 1, 1, 1, 0, 0, 1, 1, 0, 1, 1, 0, 1, 1, 0, 1, 0, 0, 0, 1, 1, 0,
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       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,test_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_test)
           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
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
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-score   support

           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 avg       0.84      0.84      0.84       400
```

[ ]:

```

```