In [ ]:
```
# 1a_BASIC PRACTICE EXPERIMENTS
# ASHISH P SHAJI
# 230701041
# 30/07/2024
```

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

In [322…
```
data=pd.read_csv('Iris - Iris.csv')
data
```

Out[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 × 5 columns

In [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
```

In [326…
```
data.describe()
```

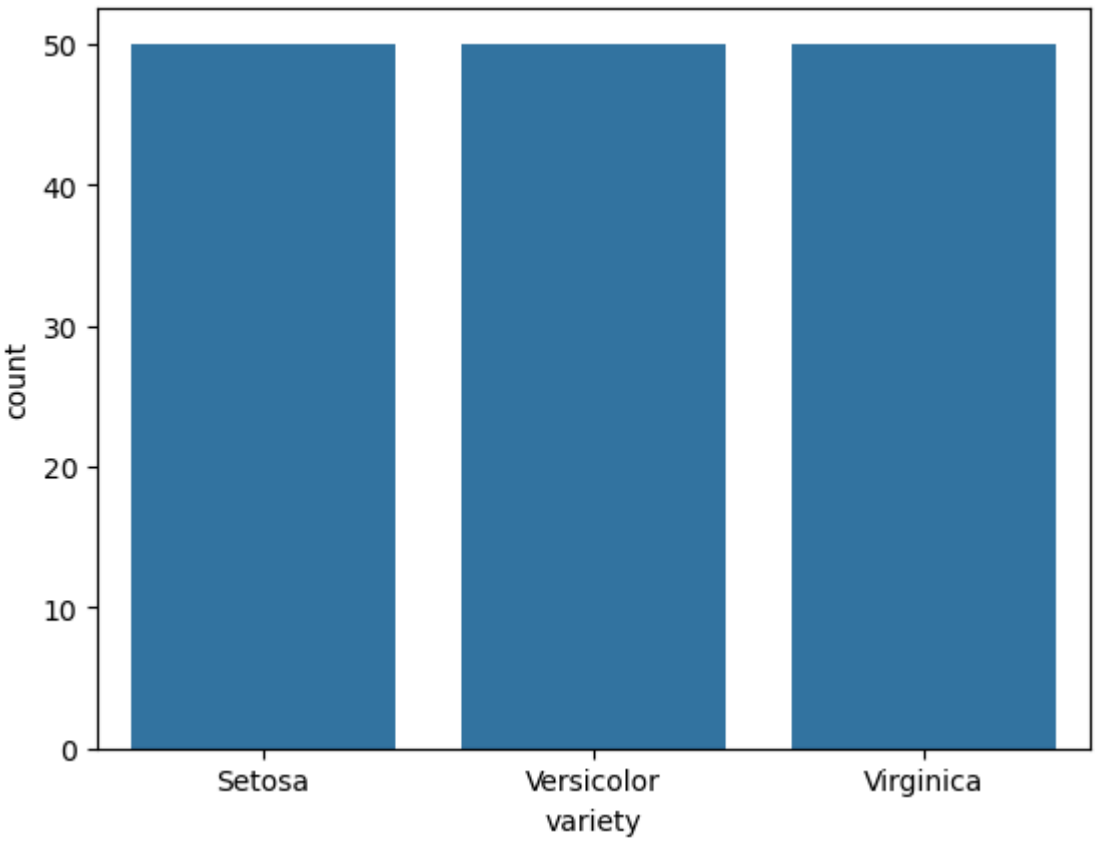
Out[326...

	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

In [328...
```
data.value_counts('variety')
```

Out[328...
```
variety
Setosa        50
Versicolor    50
Virginica     50
Name: count, dtype: int64
```

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



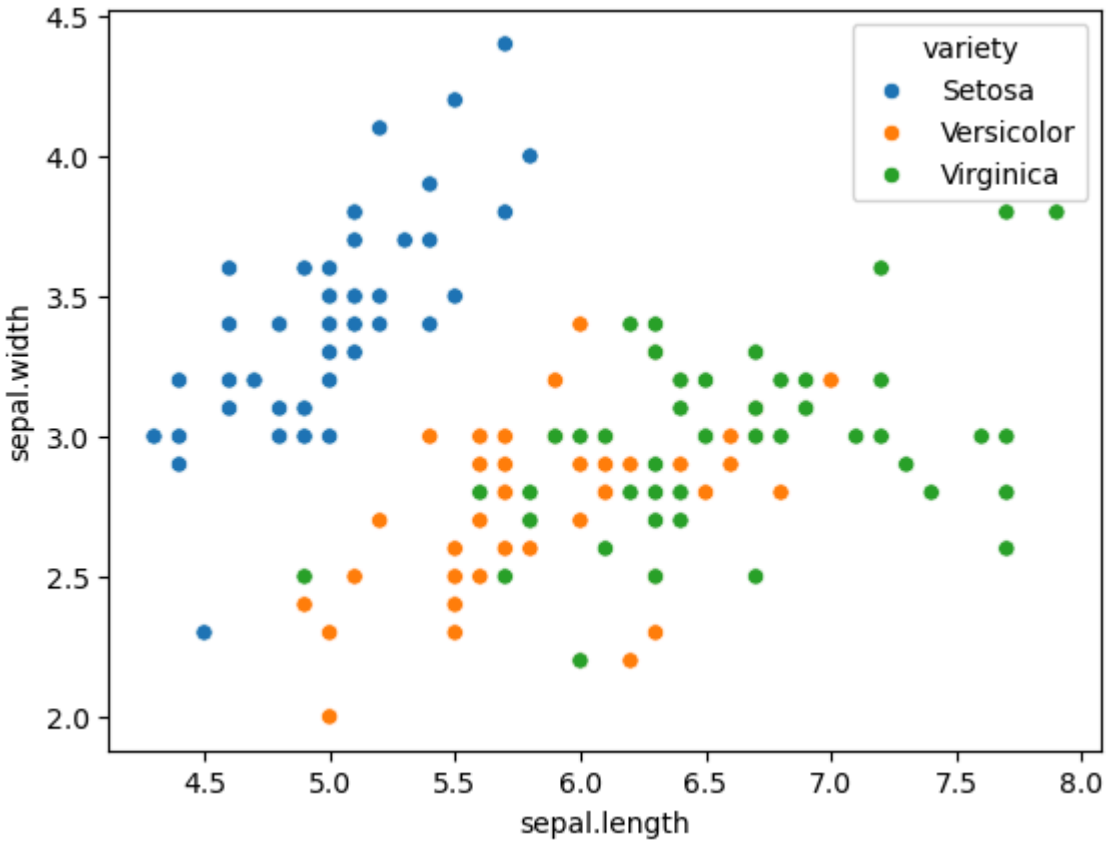
In [332...
```
dummies=pd.get_dummies(data.variety)
FinalDataset=pd.concat([pd.get_dummies(data.variety),data.iloc[:,[0,1,2,3]]],axi
FinalDataset.head()
```

Out[332…

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

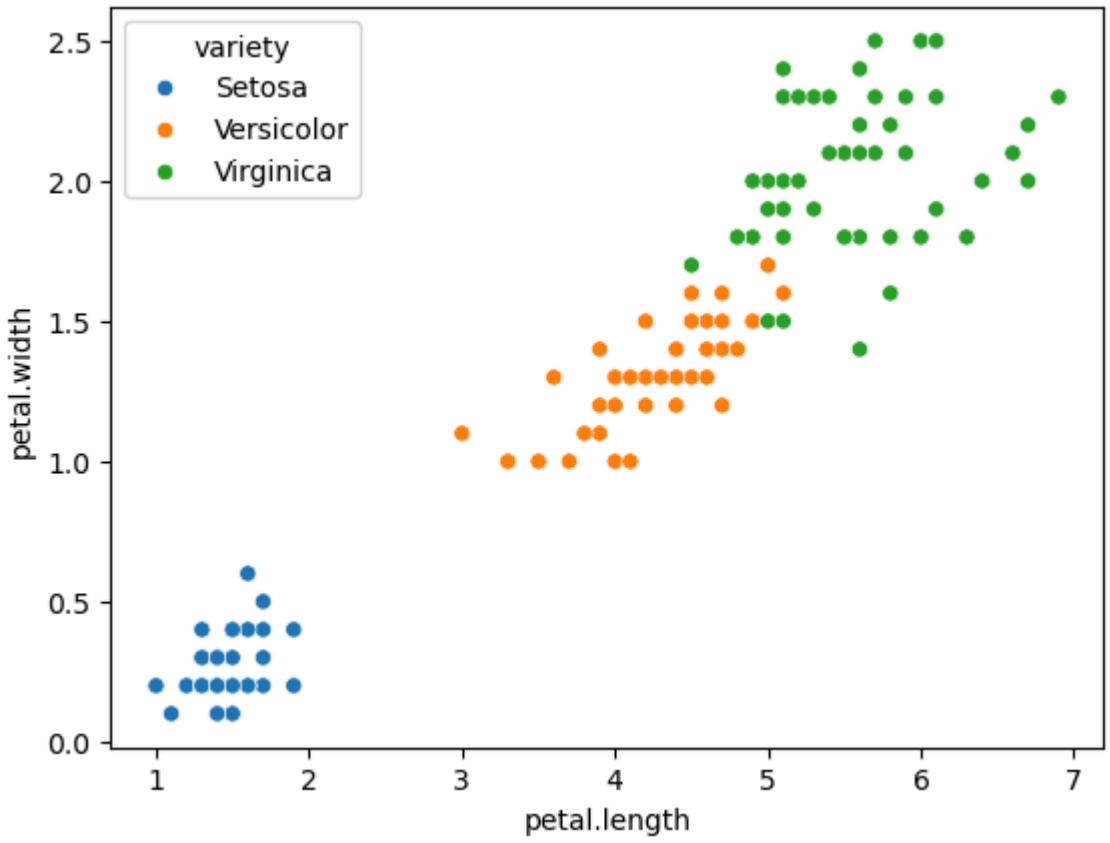
In [340…
```
sns.scatterplot(x='sepal.length',y='sepal.width',hue='variety',data=data)
```

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



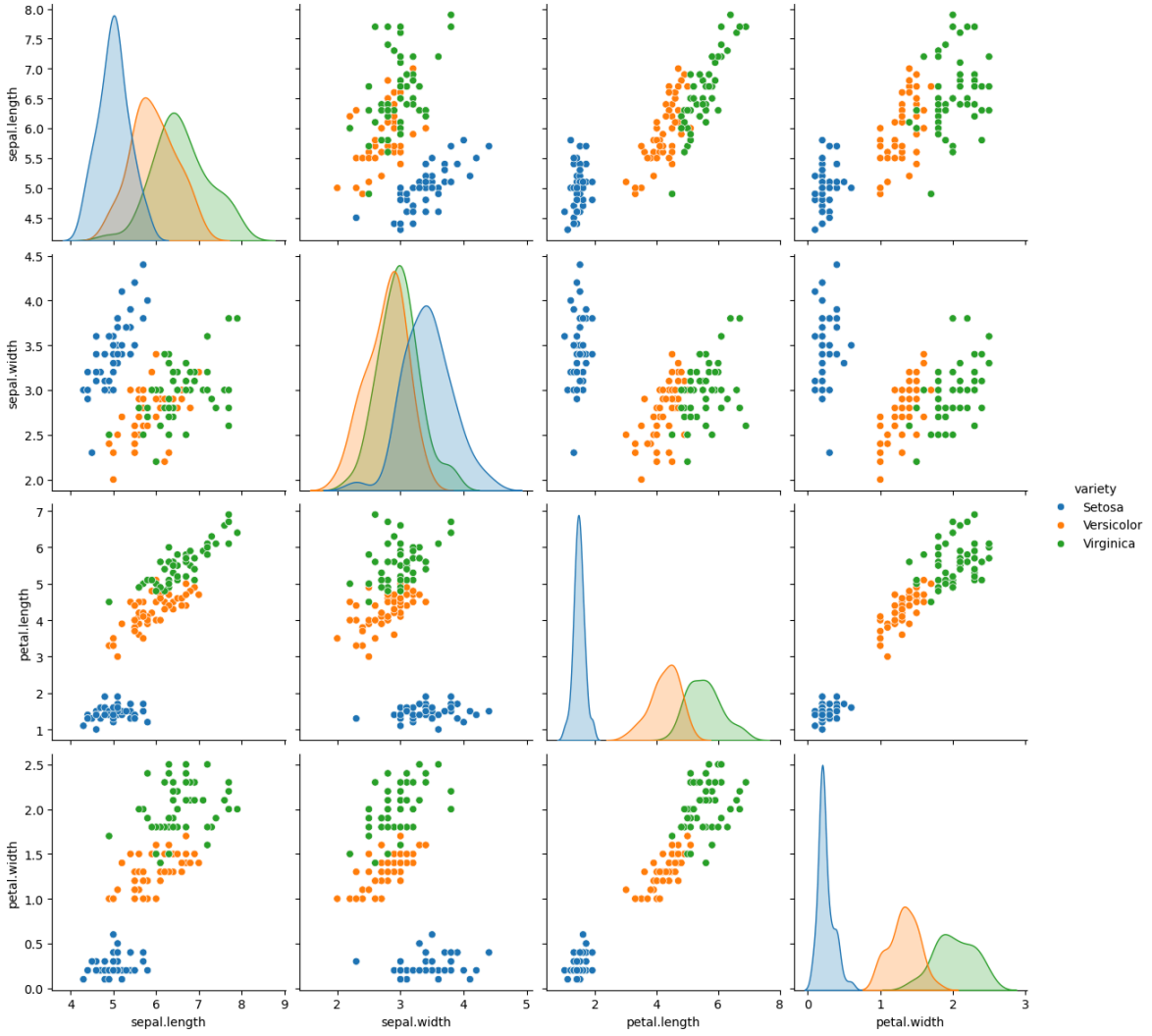
In [342…
```
sns.scatterplot(x='petal.length',y='petal.width',hue='variety',data=data,)
```

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

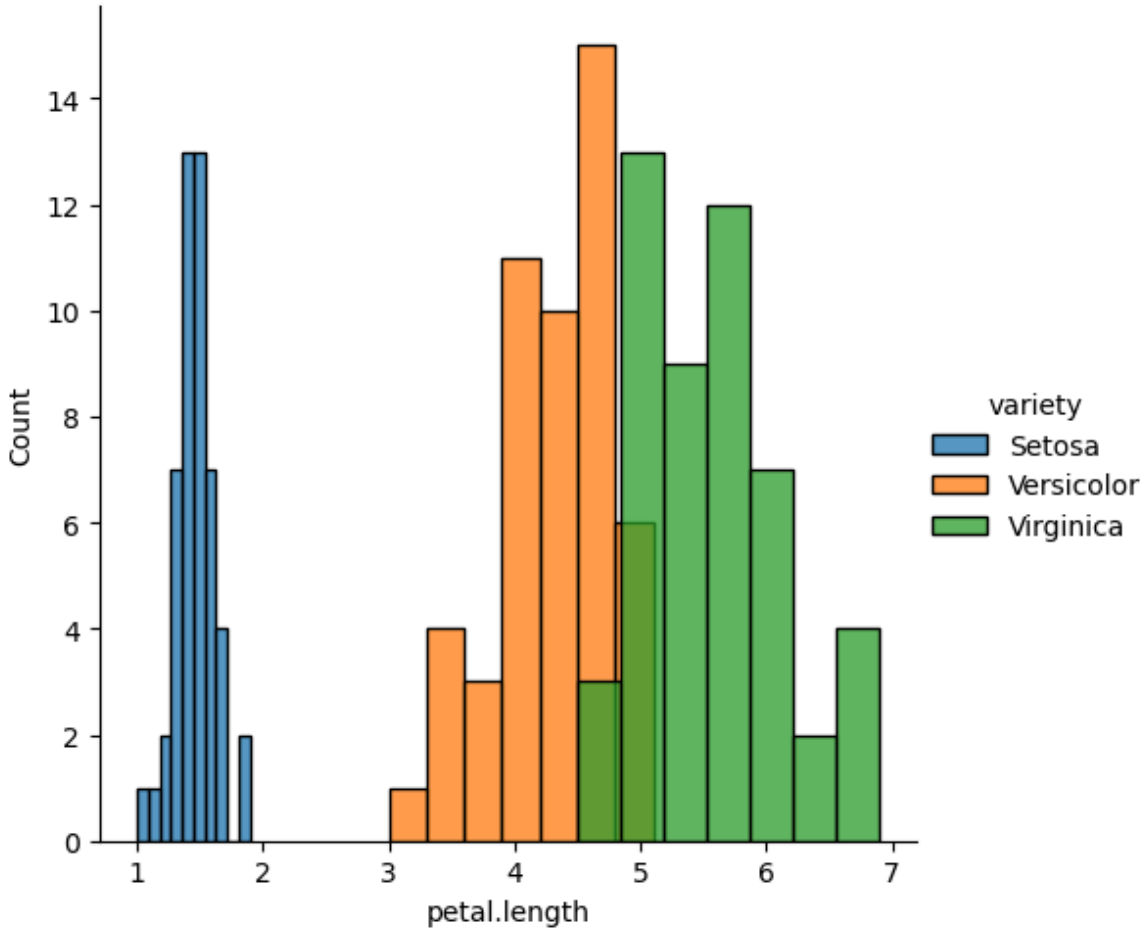


In [345…

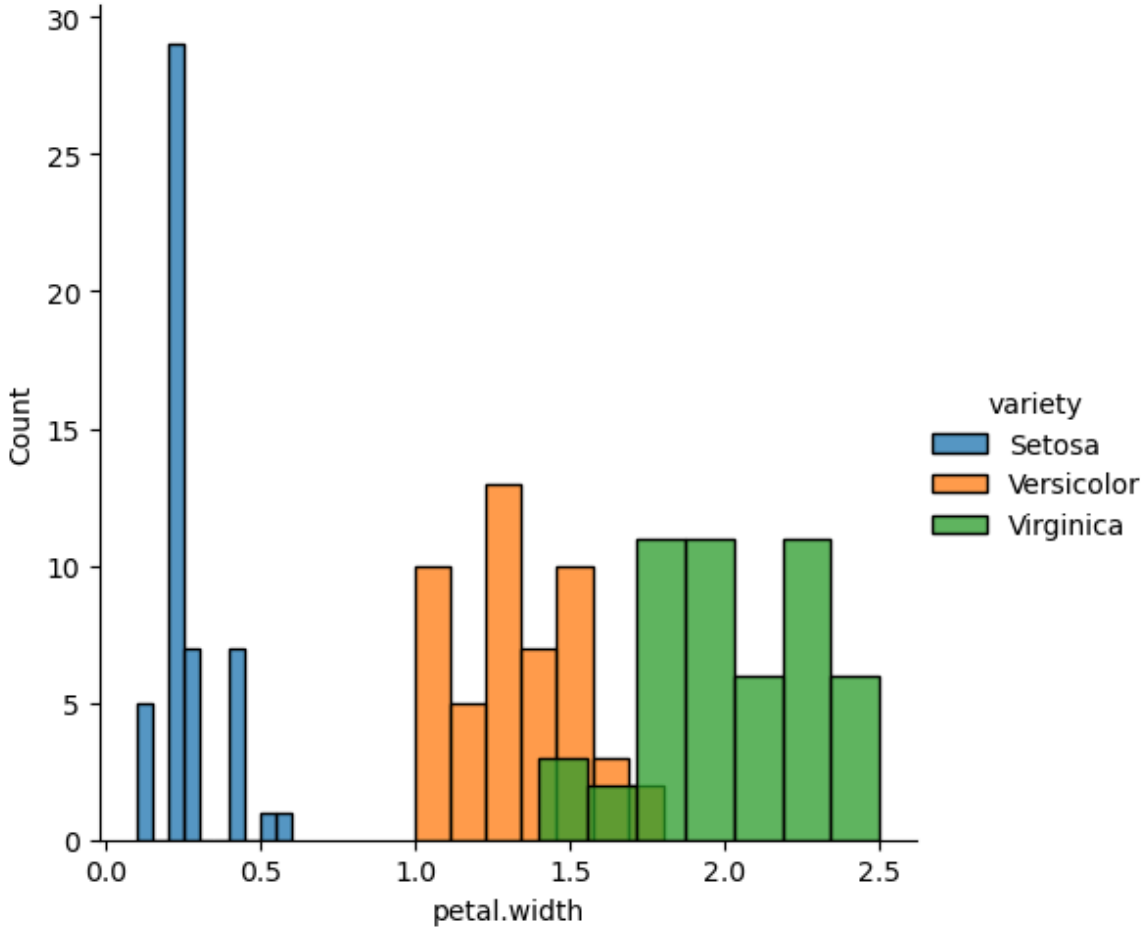
```
sns.pairplot(data,hue='variety',height=3);
```



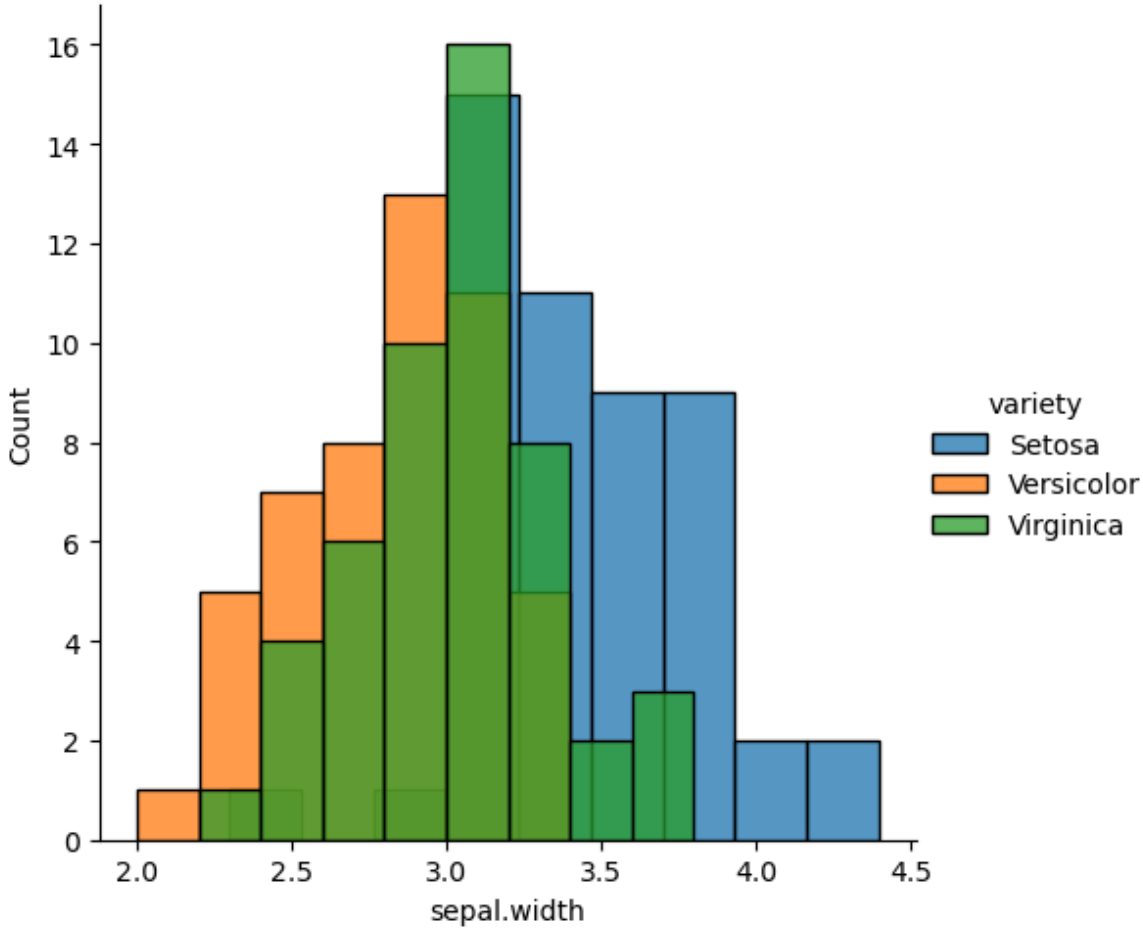
In [351…
```
sns.FacetGrid(data,hue='variety',height=5).map(sns.histplot,'petal.length').add_
plt.show();
```



In [353…
```
sns.FacetGrid(data,hue='variety',height=5).map(sns.histplot,'petal.width').add_l
plt.show();
```



In [355…
```
sns.FacetGrid(data,hue='variety',height=5).map(sns.histplot,'sepal.width').add_l
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

In [ ]:
```
# 1b_NUMPY
# ASHISH P SHAJI
# 230701041
# 06/08/2024
```

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

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

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

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

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

Out[11]:
```
1
```

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

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

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

Out[17]:
```
2
```

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

In [3]:
```
# 1b_PANDAS
# ASHISH P SHAJI
# 230701041
# 06/08/2024
```

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

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

Out[3]:

	0	1	2
0	1	Smith	50000
1	2	Jones	60000

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

Out[5]:

	Empd	Name	Salary
0	1	Smith	50000
1	2	Jones	60000

In [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
```

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

Out[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

In [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
```

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

Out[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

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

Out[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
```

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

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

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

Out[29]:
```
112012.63920000002
```

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

Out[31]:
```
107978.19
```

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

Out[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
```

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

Out[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>
```

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

Out[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>
```

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

Out[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

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

Out[41]:

	R&D Spend	Administration	Marketing Spend	State	Profit
count	50.000000	50.000000	50.000000	50	50.000000
unique	NaN	NaN	NaN	3	NaN
top	NaN	NaN	NaN	New York	NaN
freq	NaN	NaN	NaN	17	NaN
mean	73721.615600	121344.639600	211025.097800	NaN	112012.639200
std	45902.256482	28017.802755	122290.310726	NaN	40306.180338
min	0.000000	51283.140000	0.000000	NaN	14681.400000
25%	39936.370000	103730.875000	129300.132500	NaN	90138.902500
50%	73051.080000	122699.795000	212716.240000	NaN	107978.190000
75%	101602.800000	144842.180000	299469.085000	NaN	139765.977500
max	165349.200000	182645.560000	471784.100000	NaN	192261.830000

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

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

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

Out[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)
```

In [1]:
```
# 2_OUTLIER DETECTION
# ASHISH P SHAJI
# 230701041
# 13/08/2024
```

In [2]:
```
import numpy as np
array=np.random.randint(1,100,16) # randomly generate 16 numbers between 1 to 10
array
```

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

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

Out[4]:
```
47.25
```

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

Out[6]:
```
14.75
```

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

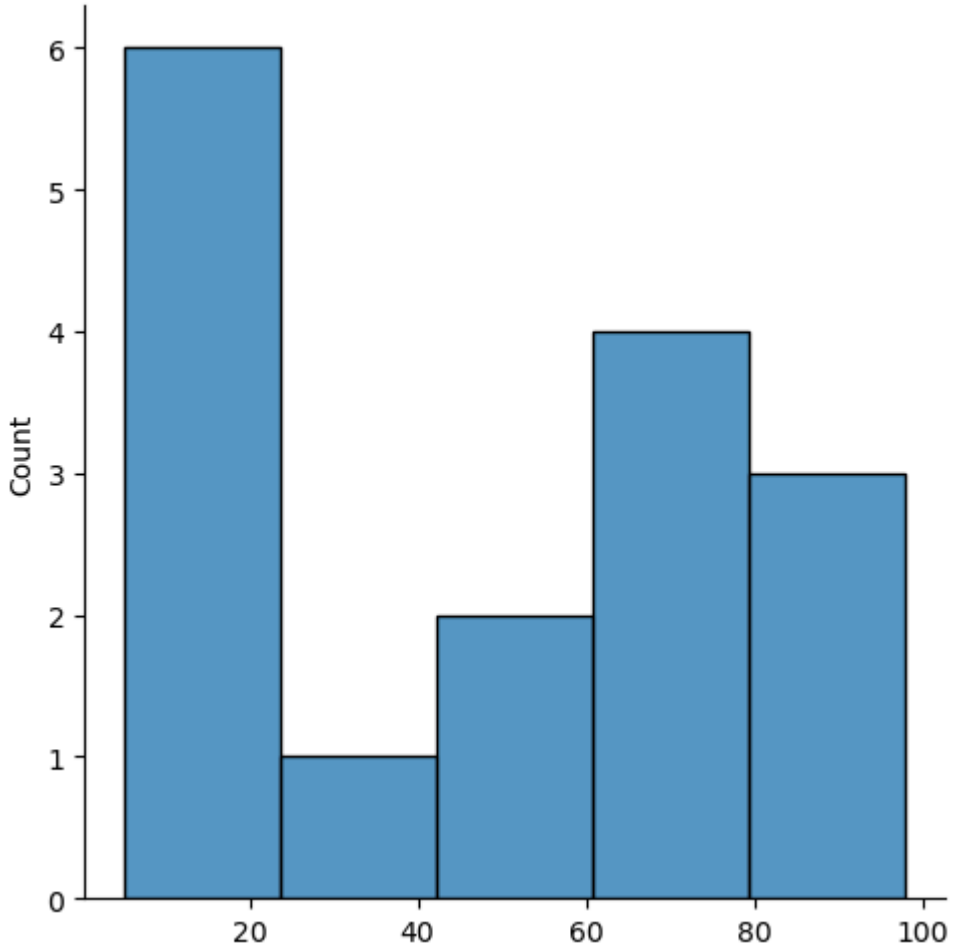
Out[8]:
```
71.5
```

In [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
```

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

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

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

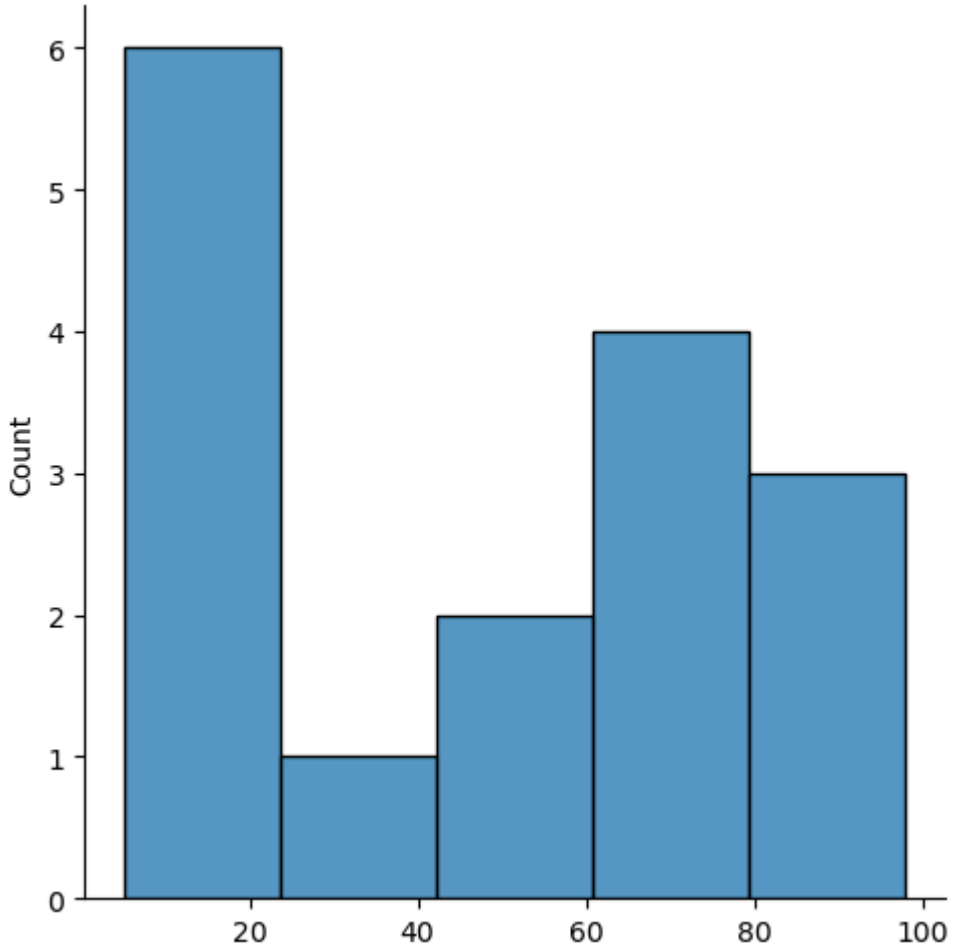


In [16]:
```
new_array=array[(array>lr) & (array<ur)]
new_array
```

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

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

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



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

Out[20]:
```
(-70.375, 156.625)
```

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

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

In [1]:
```
# 3_MISSING AND INAPPROPRIATE DATA
# ASHISH P SHAJI
# 230701041
# 20/08/2024
```

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

Out[3]:

	CustomerID	Age_Group	Rating(1-5)	Hotel	FoodPreference	Bill	NoOfPax	E
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	9	25-30	2	Ibis	Non-Veg	3456	3	
10	10	30-35	5	RedFox	non-Veg	-6755	4	

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

Out[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
```

In [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
```

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

Out[9]:

	CustomerID	Age_Group	Rating(1-5)	Hotel	FoodPreference	Bill	NoOfPax	E
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	
10	10	30-35	5	RedFox	non-Veg	-6755	4	

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

Out[11]: 10

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

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

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

Out[15]:

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

In [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
```

Out[21]:

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

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

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

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

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

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

Out[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
```

In [ ]:
```
# 4_DATA PREPROCESSING
# ASHISH P SHAJI
# 230701041
# 27/08/2024
```

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

Out[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 × 4 columns

In [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
```

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

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

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

Out[42]:
```
40
```

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

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

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

Out[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
```

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

Out[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
```

In [52]:
```
df
```

Out[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 × 4 columns

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

Out[54]:

	AADITYA PARTHA SARATHY	AAKASH V	ABHILASH G R	ABHINAYA LAKSHMI S	ABHISHEK ROBIN S A	ABHISHEK S	ABINAV S T	ABIR
0	True	False	False	False	False	False	False	F
1	False	True	False	False	False	False	False	F
2	False	False	True	False	False	False	False	F
3	False	False	False	True	False	False	False	F
4	False	False	False	False	True	False	False	F
...	...	...	...	...	...	...	...	
65	False	False	False	False	False	False	False	F
66	False	False	False	False	False	False	False	F
67	False	False	False	False	False	False	False	F
68	False	False	False	False	False	False	False	F
69	False	False	False	False	False	False	False	F

70 rows × 69 columns

In [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
```

In [3]:
```
# 5_EDA - QUANTITATIVE AND QUALITATIVE PLOTS
# ASHISH P SHAJI
# 230701041
# 03/09/2024
```

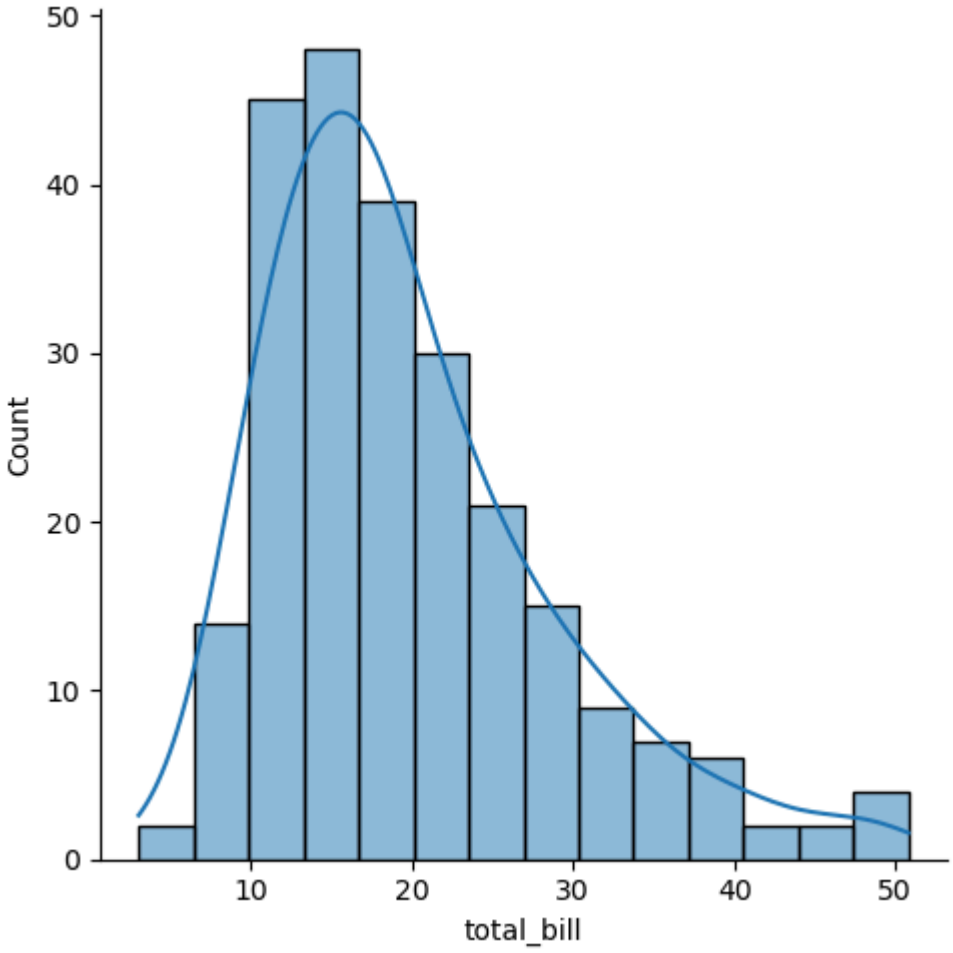
In [63]:
```
import seaborn as sns
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
%matplotlib inline
tips=sns.load_dataset('tips')
tips.head()
```

Out[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

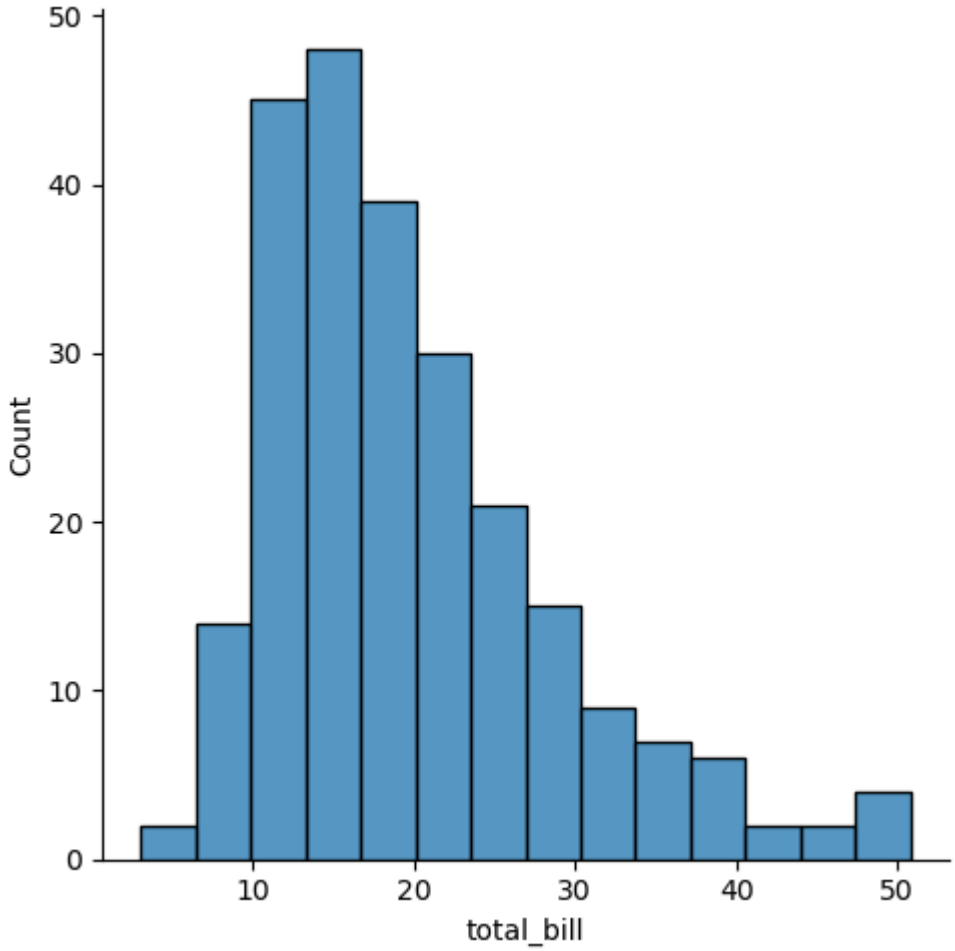
In [65]:
```
sns.displot(tips.total_bill,kde=True)
```

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



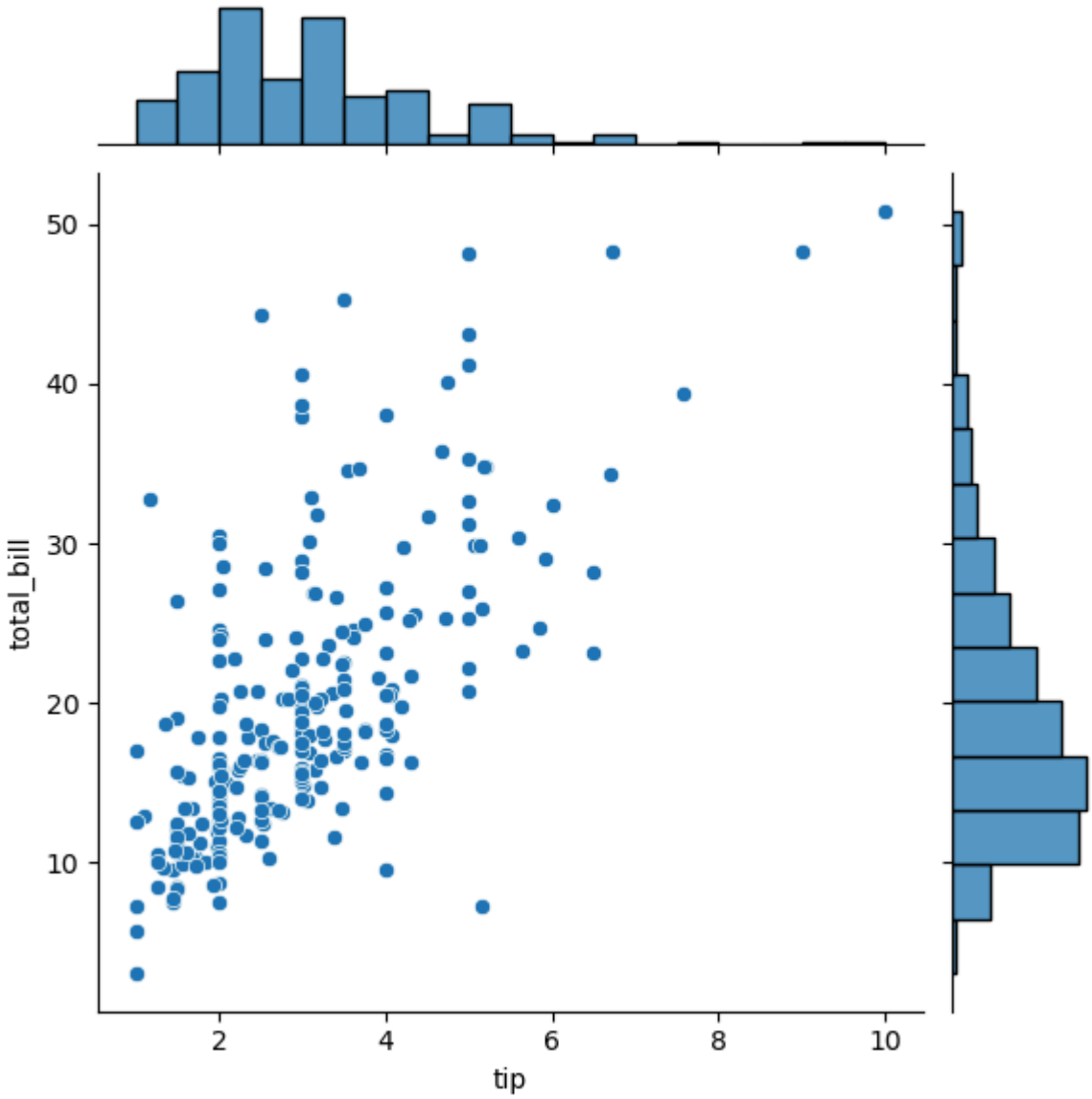
In [67]:
```
sns.displot(tips.total_bill,kde=False)
```

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



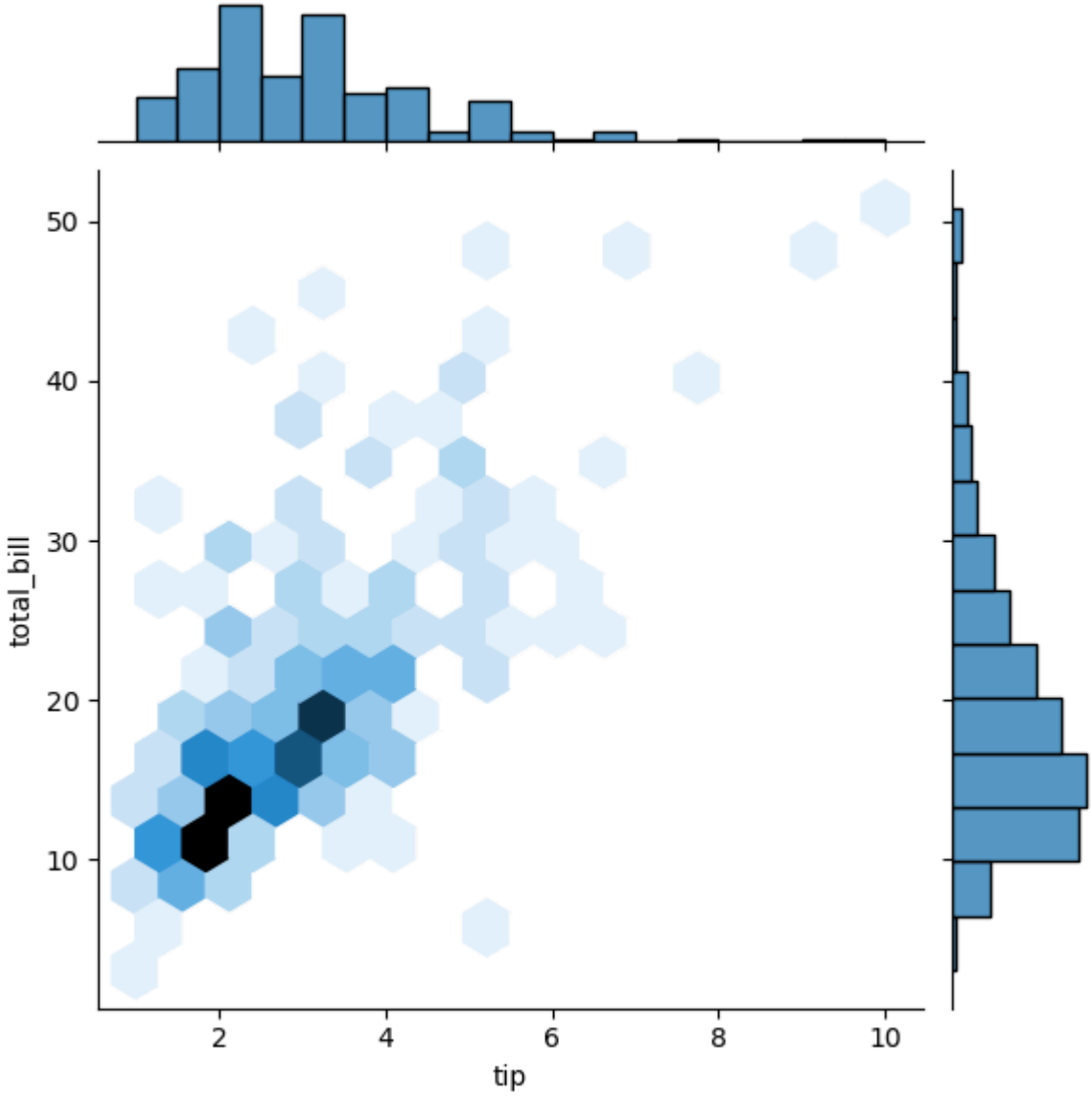
In [69]:
```
sns.jointplot(x=tips.tip,y=tips.total_bill)
```

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



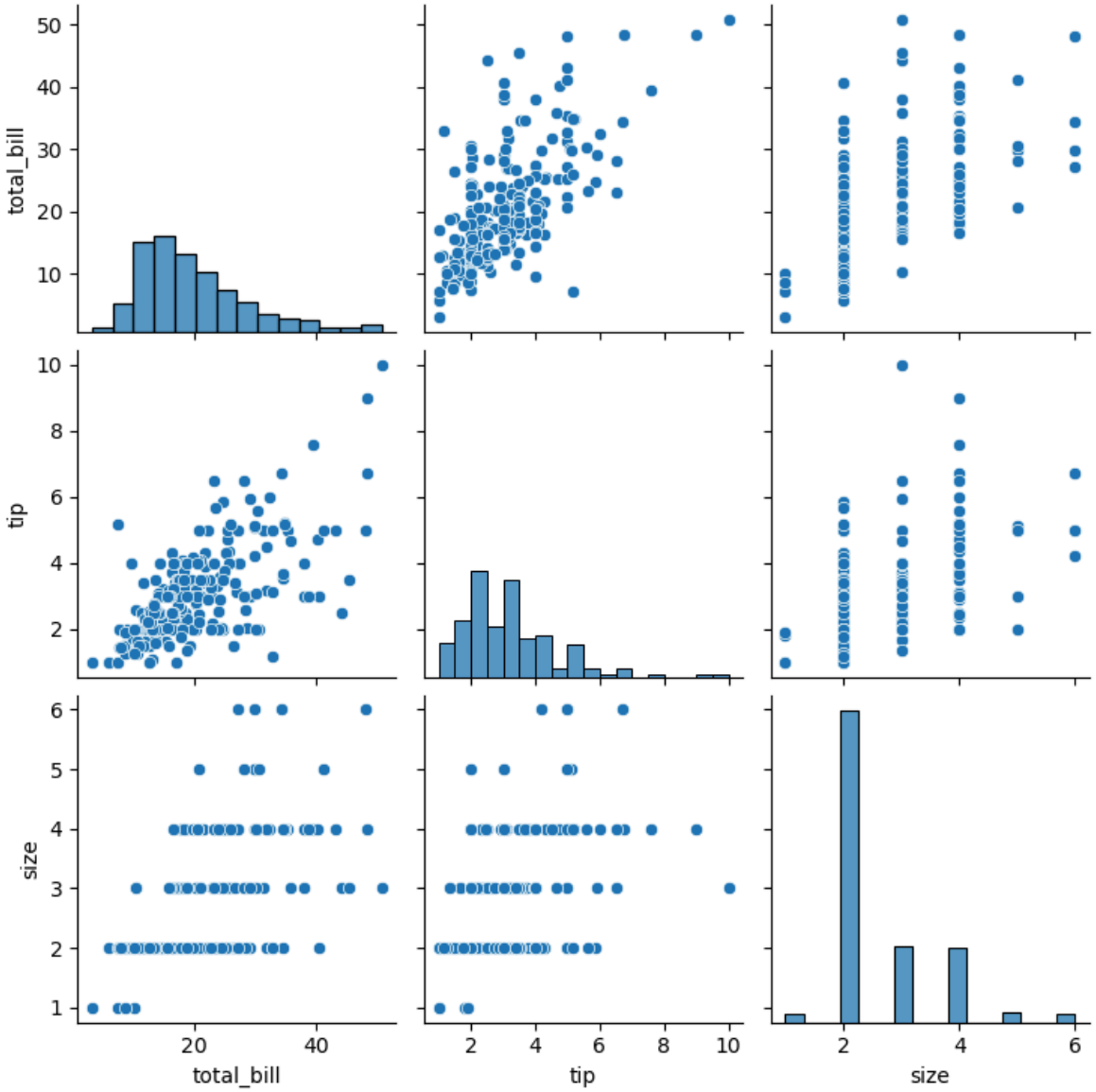
In [71]:
```
sns.jointplot(x=tips.tip,y=tips.total_bill,kind="hex")
```

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



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

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



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

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

In [ ]:
```

```

In [1]:
```
# 6_RANDOM SAMPLING
# ASHISH P SHAJI
# 230701041
# 10/09/2024
```

In [182…
```
import numpy as np
import matplotlib.pyplot as plt
```

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

In [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] = []
```

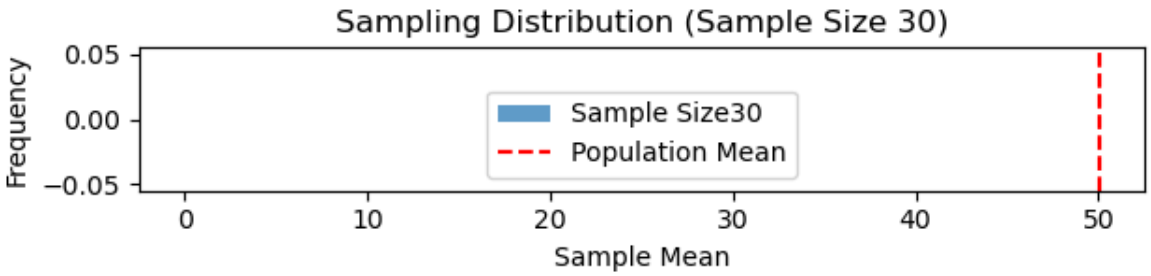
In [188…
```
for _ in range(num_samples):
    sample = np.random.choice(population, size=size, replace=False)
    sample_means[size].append(np.mean(sample))
```

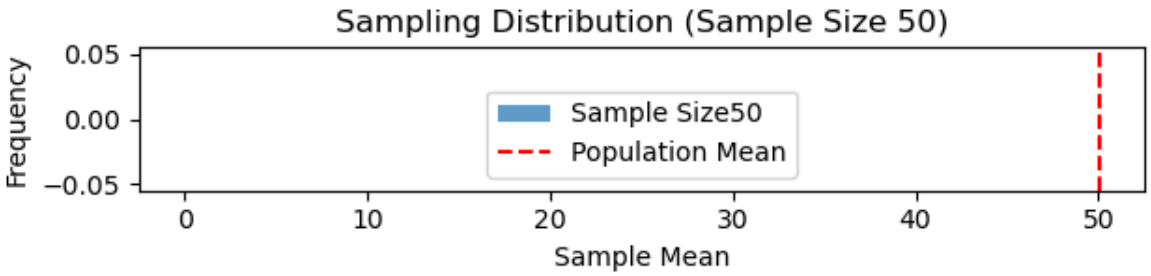
In [189…
```
plt.figure(figsize=(12, 8))
```

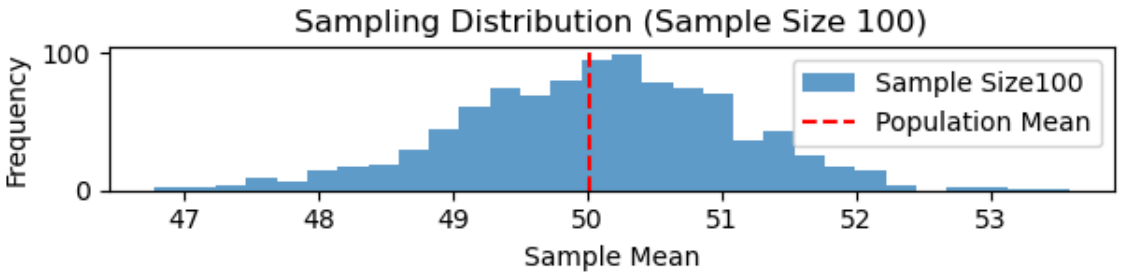
Out[189… <Figure size 1200x800 with 0 Axes>

<Figure size 1200x800 with 0 Axes>

In [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=
    plt.title(f'Sampling Distribution (Sample Size {size})')
    plt.xlabel('Sample Mean')
    plt.ylabel('Frequency')
    plt.legend()
plt.tight_layout()
plt.show()
```


Sampling Distribution (Sample Size 30)
Frequency
0.05
0.00
−0.05
Sample Size30
Population Mean
0
10
20
30
40
50
Sample Mean


Sampling Distribution (Sample Size 50)
Frequency
0.05
0.00
−0.05
Sample Size50
Population Mean
0
10
20
30
40
50
Sample Mean


Sampling Distribution (Sample Size 100)
Frequency
100
0
Sample Size100
Population Mean
47
48
49
50
51
52
53
Sample Mean

In [1]:
```
# 7_Z TEST
# ASHISH P SHAJI
# 230701041
# 10/09/2024
```

In [236…
```
import numpy as np
import scipy.stats as stats
```

In [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])
```

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

In [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)))
```

In [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
```

In [246…
```
alpha = 0.05
if p_value < alpha:
    print("Reject the null hypothesis: The average weight is significantly diffe
else:
    print("Fail to reject the null hypothesis: There is no significant differenc
```

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

In [ ]:

In [ ]:

In [1]:
```
# 8_T TEST
# ASHISH P SHAJI
# 230701041
# 08/10/2024
```

In [262…
```
import numpy as np
import scipy.stats as stats
```

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

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

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

In [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
```

In [272…
```
alpha = 0.05
if p_value < alpha:
    print("Reject the null hypothesis: The average IQ SCORE is significantly dif
else:
    print("Fail to reject the null hypothesis: There is no significant differenc
```

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

In [1]:
```
# 9_ANOVA TEST
# ASHISH P SHAJI
# 230701041
# 08/10/2024
```

In [302…
```
import numpy as np
import scipy.stats as stats
```

In [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)
```

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

In [308…
```
f_statistic, p_value = stats.f_oneway(growth_A, growth_B, growth_C)
```

In [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
```

In [312…
```
alpha = 0.05
if p_value < alpha:
    print("Reject the null hypothesis: There is a significant difference in mean
else:
    print("Fail to reject the null hypothesis: There is no significant differenc
```

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

In [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
-----------------------------------------------------
```

In [ ]:

In [1]:
```
# 10_FEATURE_SCALING
# ASHISH P SHAJI
# 230701041
# 22/10/2024
```

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

Out[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 × 4 columns

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

Out[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

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

Out[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 × 4 columns

In [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]])
```

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

In [106…
```
SimpleImputer()
```

Out[106…
```
SimpleImputer()
```

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

Out[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)
```

In [116…

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

Out[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.]])
```

In [118…

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

Out[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)
```

In [1]:
```
# 11_LINEAR_REGRESSION
# ASHISH P SHAJI
# 230701041
# 29/10/2024
```

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

Out[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

In [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
```

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

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

Out[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

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

In [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,rand
```

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

Out[16]:

▾ LinearRegression

```
LinearRegression()
```

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

Out[18]:
```
0.9411949620562126
```

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

Out[20]:
```
0.988169515729126
```

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

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

In [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)
```

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

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

In [ ]:

In [ ]:
```
# 12_LOGISTIC REGRESSION
# ASHISH P SHAJI
# 230701041
# 05/11/2024
```

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

Out[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 × 5 columns

In [129…
```
df.head()
```

Out[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

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

Out[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],
       [    25,  22000],
       [    24,  23000],
       [    31,  34000],
```

```
[    26,  16000],
[    31,  71000],
[    32, 117000],
[    33,  43000],
[    33,  60000],
[    31,  66000],
[    20,  82000],
[    33,  41000],
[    35,  72000],
[    28,  32000],
[    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],
[    59, 143000],
[    41,  80000],
[    35,  91000],
[    37, 144000],
[    60, 102000],
[    35,  60000],
[    37,  53000],
[    36, 126000],
[    56, 133000],
[    40,  72000],
[    42,  80000],
[    35, 147000],
[    39,  42000],
[    40, 107000],
[    49,  86000],
[    38, 112000],
[    46,  79000],
[    40,  57000],
[    37,  80000],
[    46,  82000],
[    53, 143000],
```

```
[    42, 149000],
[    38,  59000],
[    50,  88000],
[    56, 104000],
[    41,  72000],
[    51, 146000],
[    35,  50000],
[    57, 122000],
[    41,  52000],
[    35,  97000],
[    44,  39000],
[    37,  52000],
[    48, 134000],
[    37, 146000],
[    50,  44000],
[    52,  90000],
[    41,  72000],
[    40,  57000],
[    58,  95000],
[    45, 131000],
[    35,  77000],
[    36, 144000],
[    55, 125000],
[    35,  72000],
[    48,  90000],
[    42, 108000],
[    40,  75000],
[    37,  74000],
[    47, 144000],
[    40,  61000],
[    43, 133000],
[    59,  76000],
[    60,  42000],
[    39, 106000],
[    57,  26000],
[    57,  74000],
[    38,  71000],
[    49,  88000],
[    52,  38000],
[    50,  36000],
[    59,  88000],
[    35,  61000],
[    37,  70000],
[    52,  21000],
[    48, 141000],
[    37,  93000],
[    37,  62000],
[    48, 138000],
[    41,  79000],
[    37,  78000],
[    39, 134000],
[    49,  89000],
[    55,  39000],
[    37,  77000],
[    35,  57000],
[    36,  63000],
[    42,  73000],
[    43, 112000],
[    45,  79000],
[    46, 117000],
```

```
       [    58,  38000],
       [    48,  74000],
       [    37, 137000],
       [    37,  79000],
       [    40,  60000],
       [    42,  54000],
       [    51, 134000],
       [    47, 113000],
       [    36, 125000],
       [    38,  50000],
       [    42,  70000],
       [    39,  96000],
       [    38,  50000],
       [    49, 141000],
       [    39,  79000],
       [    39,  75000],
       [    54, 104000],
       [    35,  55000],
       [    45,  32000],
       [    36,  60000],
       [    52, 138000],
       [    53,  82000],
       [    41,  52000],
       [    48,  30000],
       [    48, 131000],
       [    41,  60000],
       [    41,  72000],
       [    42,  75000],
       [    36, 118000],
       [    47, 107000],
       [    38,  51000],
       [    48, 119000],
       [    42,  65000],
       [    40,  65000],
       [    57,  60000],
       [    36,  54000],
       [    58, 144000],
       [    35,  79000],
       [    38,  55000],
       [    39, 122000],
       [    53, 104000],
       [    35,  75000],
       [    38,  65000],
       [    47,  51000],
       [    47, 105000],
       [    41,  63000],
       [    53,  72000],
       [    54, 108000],
       [    39,  77000],
       [    38,  61000],
       [    38, 113000],
       [    37,  75000],
       [    42,  90000],
       [    37,  57000],
       [    36,  99000],
       [    60,  34000],
       [    54,  70000],
       [    41,  72000],
       [    40,  71000],
       [    42,  54000],
```

```
[    43, 129000],
[    53,  34000],
[    47,  50000],
[    42,  79000],
[    42, 104000],
[    59,  29000],
[    58,  47000],
[    46,  88000],
[    38,  71000],
[    54,  26000],
[    60,  46000],
[    60,  83000],
[    39,  73000],
[    59, 130000],
[    37,  80000],
[    46,  32000],
[    46,  74000],
[    42,  53000],
[    41,  87000],
[    58,  23000],
[    42,  64000],
[    48,  33000],
[    44, 139000],
[    49,  28000],
[    57,  33000],
[    56,  60000],
[    49,  39000],
[    39,  71000],
[    47,  34000],
[    48,  35000],
[    48,  33000],
[    47,  23000],
[    45,  45000],
[    60,  42000],
[    39,  59000],
[    46,  41000],
[    51,  23000],
[    50,  20000],
[    36,  33000],
[    49,  36000]], dtype=int64)
```

In [133…

```
label
```

Out[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, 0, 1, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 1, 1, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 1, 0, 1, 0, 1, 0, 1, 0, 1, 1, 0, 0, 0, 1, 0, 0, 0, 1,
       0, 1, 1, 1, 0, 0, 1, 1, 0, 1, 1, 0, 1, 1, 0, 1, 0, 0, 0, 1, 1, 0,
       1, 1, 0, 1, 0, 1, 0, 1, 0, 0, 1, 1, 0, 1, 0, 0, 1, 1, 0, 1, 1, 0,
       1, 1, 0, 0, 1, 0, 0, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 0, 1, 1, 0, 1,
       0, 1, 0, 1, 1, 1, 1, 0, 0, 0, 1, 1, 0, 1, 1, 1, 1, 1, 0, 0, 0, 1,
       1, 0, 0, 1, 0, 1, 0, 1, 1, 0, 1, 0, 1, 1, 0, 1, 1, 0, 0, 0, 1, 1,
       0, 1, 0, 0, 1, 0, 1, 0, 0, 1, 1, 0, 0, 1, 1, 0, 1, 1, 0, 0, 1, 0,
       1, 0, 1, 1, 1, 0, 1, 0, 1, 1, 1, 0, 1, 1, 1, 1, 0, 1, 1, 1, 0, 1,
       0, 1, 0, 0, 1, 1, 0, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 0, 1,
       1, 1, 0, 1], dtype=int64)
```

In [135…
```
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LogisticRegression
```

In [141…
```
for i in range(1,401):
    x_train,x_test,y_train,y_test=train_test_split(features,label,test_size=0.2,
    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
```

In [143…
```
x_train,x_test,y_train,y_test=train_test_split(features,label,test_size=0.2, ran
finalModel=LogisticRegression()
finalModel.fit(x_train,y_train)
```

Out[143…
```
LogisticRegression()
```

In [145…
```
print(finalModel.score(x_train,y_train))
print(finalModel.score(x_test,y_test))
```

```
0.81875
0.95
```

In [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
```

In [ ]: