230701237-fds-lab-manual

November 20, 2024

[ ]:
```
#EX.NO :1.a   Basic Practice Experiments(1 to 4)
#DATA  :  30.07.2024

#NAME : KK SHYAAM
#ROLL NO : 230701313
#DEPARTMENT : B.E COMPUTER SCIENCE AND ENGINEERING - E
```

[2]:
```
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
%matplotlib inline
```

[3]:
```
data=pd.read_csv('Iris.csv')
data
```

[3]:

	Id	SepalLengthCm	SepalWidthCm	PetalLengthCm	PetalWidthCm	Species
0	1	5.1	3.5	1.4	0.2	Iris-setosa
1	2	4.9	3.0	1.4	0.2	Iris-setosa
2	3	4.7	3.2	1.3	0.2	Iris-setosa
3	4	4.6	3.1	1.5	0.2	Iris-setosa
4	5	5.0	3.6	1.4	0.2	Iris-setosa
..	…	…	…	…	…	…
145	146	6.7	3.0	5.2	2.3	
146	147	6.3	2.5	5.0	1.9	
147	148	6.5	3.0	5.2	2.0	
148	149	6.2	3.4	5.4	2.3	
149	150	5.9	3.0	5.1	1.8	

```
145  Iris-virginica
146  Iris-virginica
147  Iris-virginica
148  Iris-virginica
149  Iris-virginica

[150 rows x 6 columns]
```

[4]:
```
data.info()
```

```
<class
'pandas.core.frame.DataFrame'>
RangeIndex: 150 entries, 0 to
149 Data columns (total 6
columns):
 # Column Non-Null Count Dtype --- ---
--- -------------- -----
 0   Id           150 non-null  int64
 1   SepalLengthCm 150 non-nullfloat64
 2   SepalWidthCm150 non-null  float64
 3   PetalLengthCm 150 non-nullfloat64
 4   PetalWidthCm150 non-null  float64
 5   Species      150 non-null  object
dtypes: float64(4), int64(1), object(1)
memory usage: 7.2+ KB
```

[5]:
```
data.describe()
```

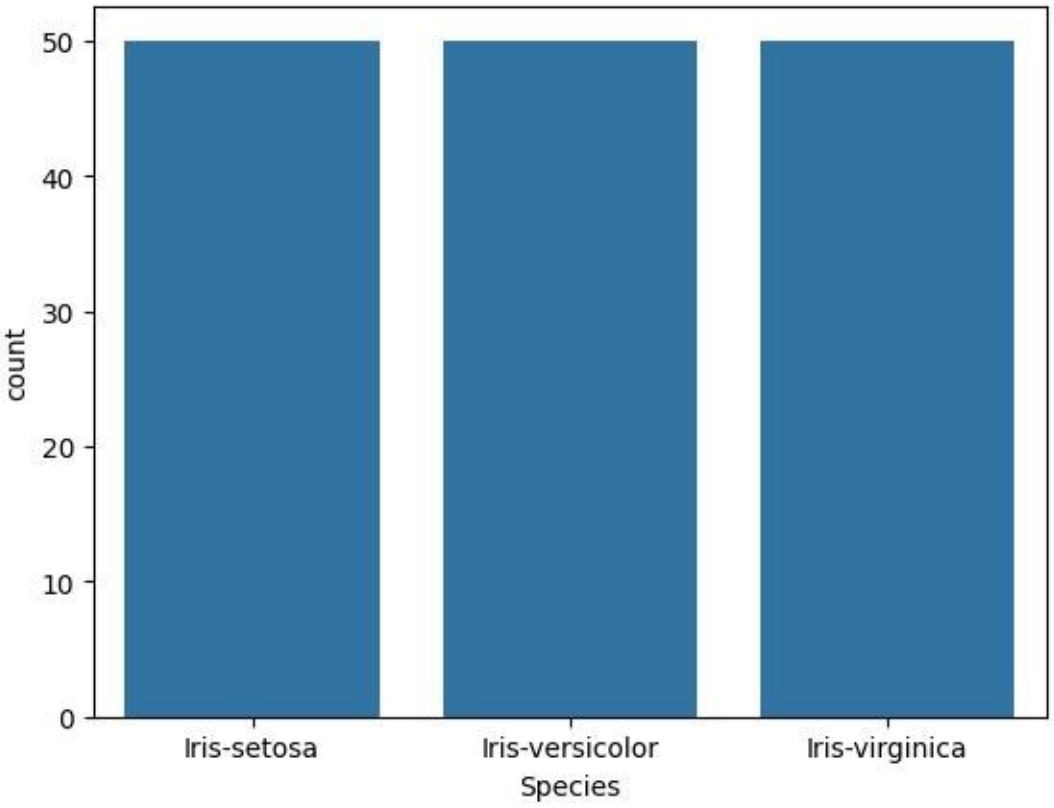
[5]:

	Id	SepalLengthCm	SepalWidthCm	PetalLengthCm	PetalWidthCm
count	150.000000	150.000000	150.000000	150.000000	150.000000
mean	75.500000	5.843333	3.054000	3.758667	1.198667
std	43.445368	0.828066	0.433594	1.764420	0.763161
min	1.000000	4.300000	2.000000	1.000000	0.100000
25%	38.250000	5.100000	2.800000	1.600000	0.300000
50%	75.500000	5.800000	3.000000	4.350000	1.300000
75%	112.750000	6.400000	3.300000	5.100000	1.800000
max	150.000000	7.900000	4.400000	6.900000	2.500000

[6]:
```
data.value_counts('Species')
```

[6]:
```
Species
Iris-setosa      50
Iris-versicolor  50
Iris-virginica   50
 Name: count, dtype: int64
```

[7]:
```
sns.countplot(x='Species',data=data,)
plt.show()
```



[8]:
```
dummies=pd.get_dummies(data.Species)
```

[9]:
```
FinalDataset=pd.concat([pd.get_dummies(data.Species),data.iloc[:
 ,[0,1,2,3]]],axis=1)
```

[10]:
```
FinalDataset.head()
```

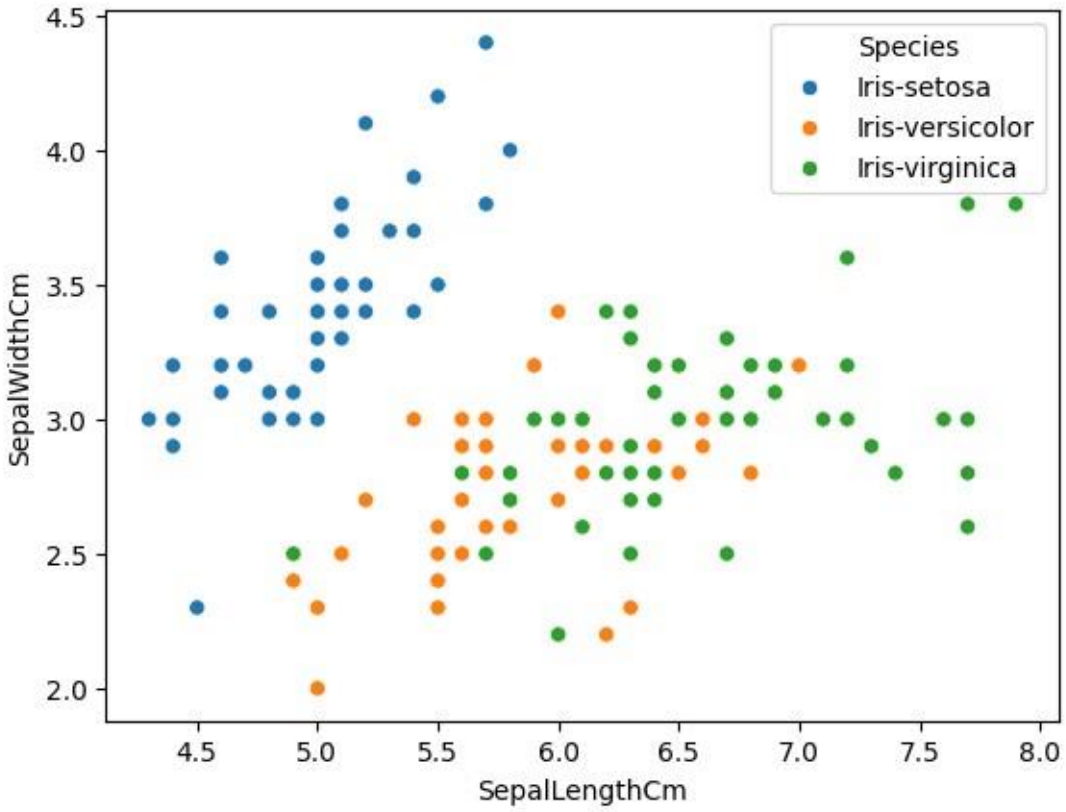
[10]:

	Iris-setosa	Iris-versicolor	Iris-virginica	Id	SepalLengthCm	SepalWidthCm	PetalLengthCm
0	True	False	False	1	5.1	3.5	1.4
1	True	False	False	2	4.9	3.0	1.4
2	True	False	False	3	4.7		
3	True	False	False	4	4.6		
4	True	False	False	5	5.0		

```
2           3.2    1.3
3           3.1    1.5
4           3.6    1.4
```

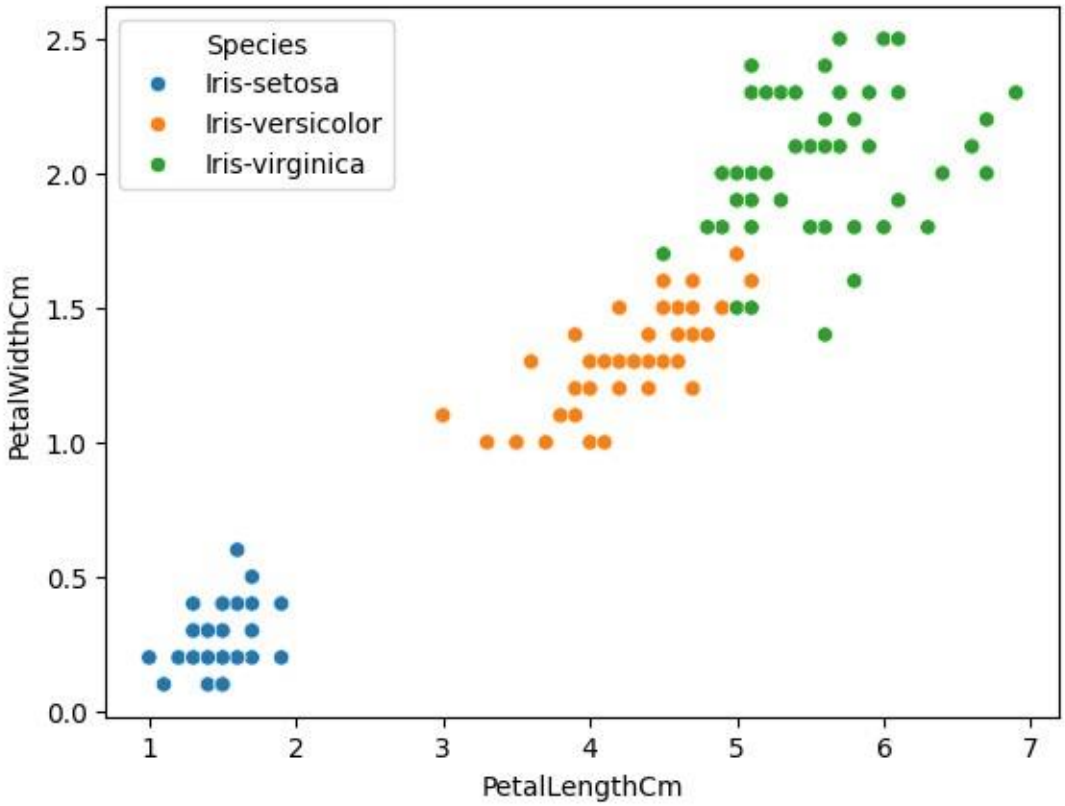
[11]:
```
sns.scatterplot(x='SepalLengthCm',y='SepalWidthCm',hue='Species',data=data
,)
```

[11]: <Axes: xlabel='SepalLengthCm', ylabel='SepalWidthCm'>

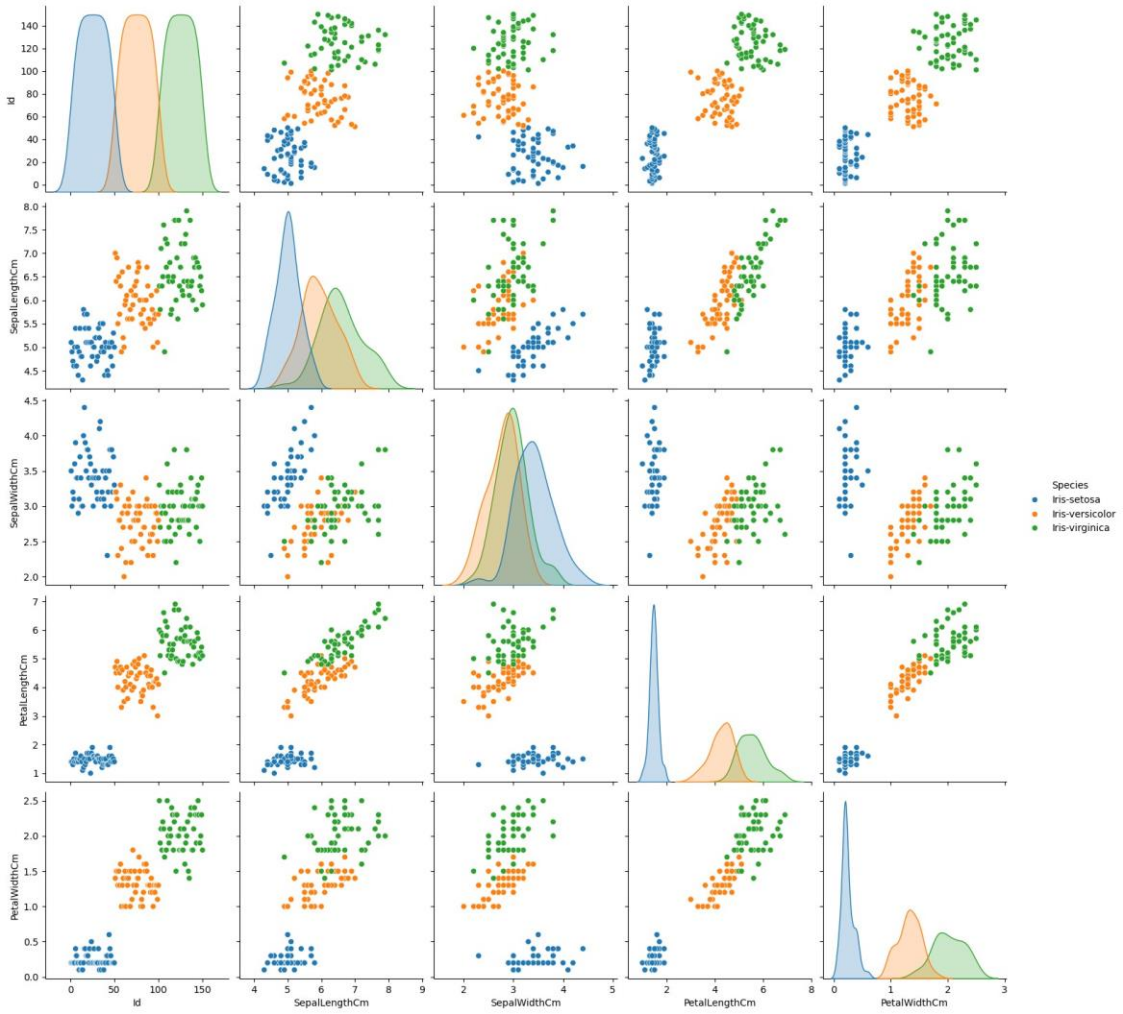


[12]:
```
sns.scatterplot(x='PetalLengthCm',y='PetalWidthCm',hue='Species',data=data
,)
```

[12]: <Axes: xlabel='PetalLengthCm', ylabel='PetalWidthCm'>

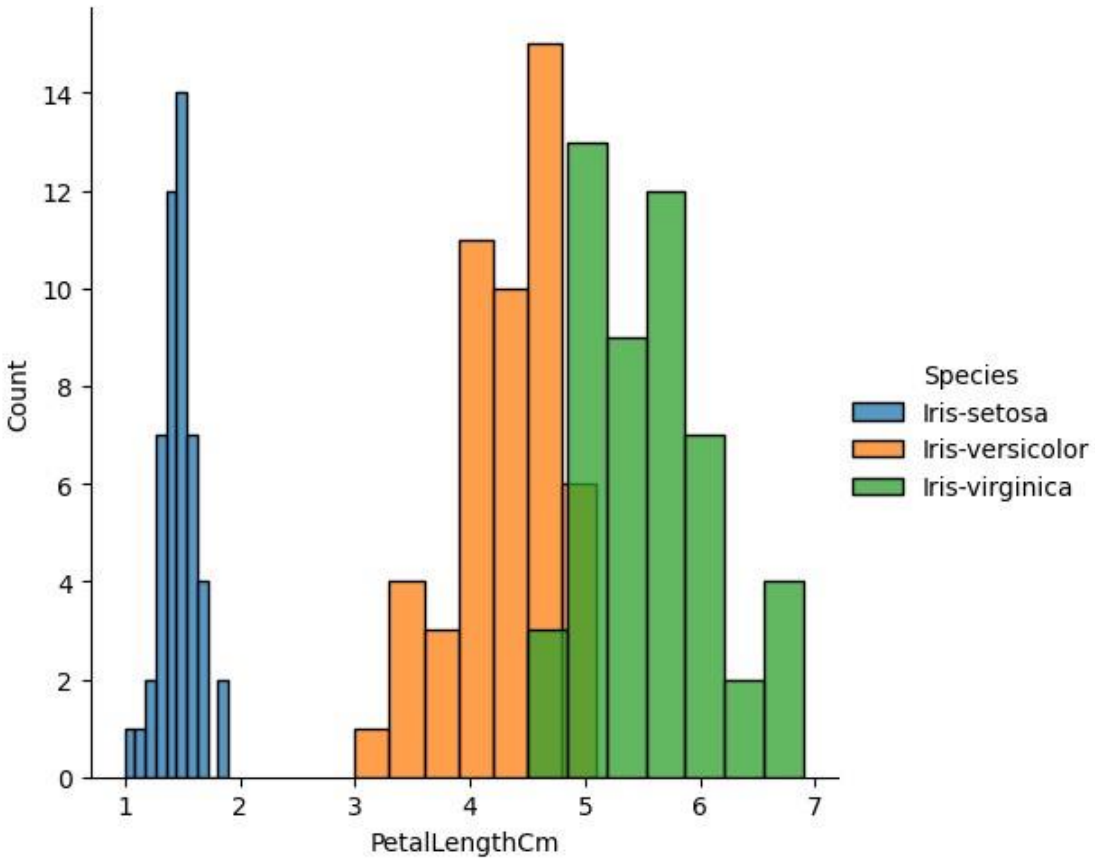


[13]:
```
sns.pairplot(data,hue='Species',height=3);
```

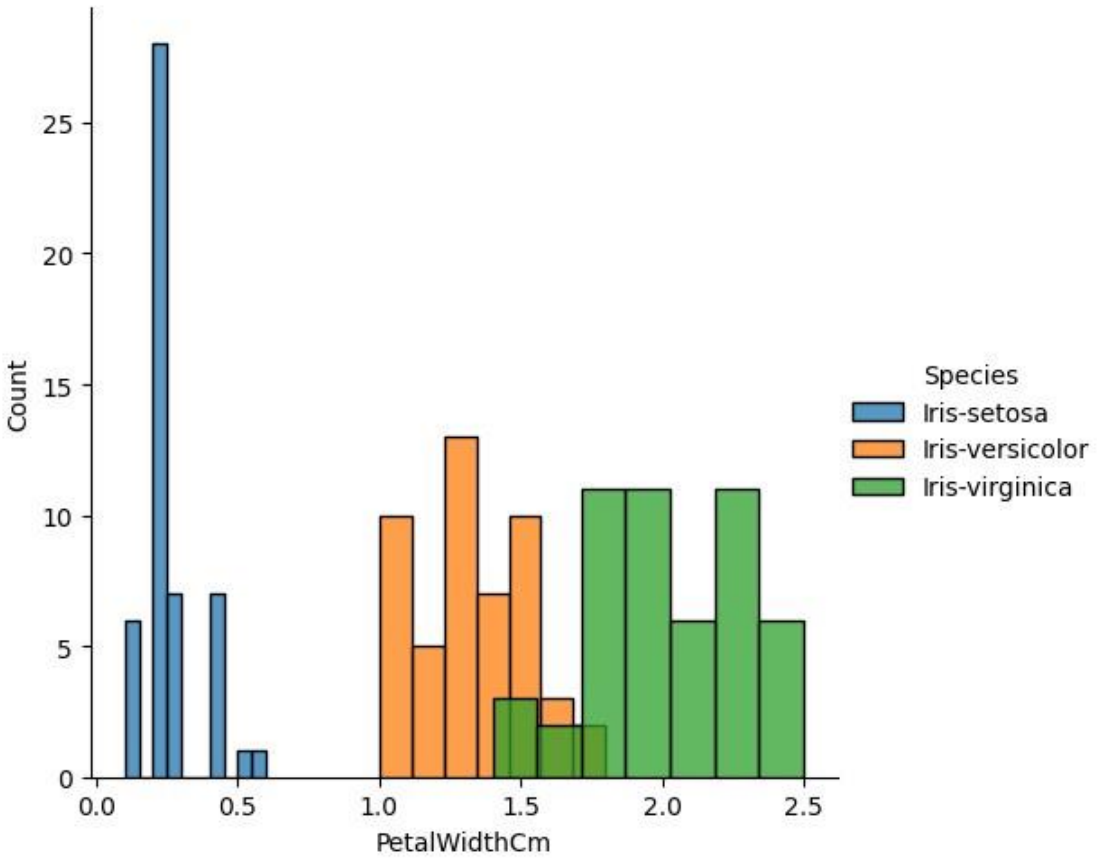


[14]:
```
plt.show()
```

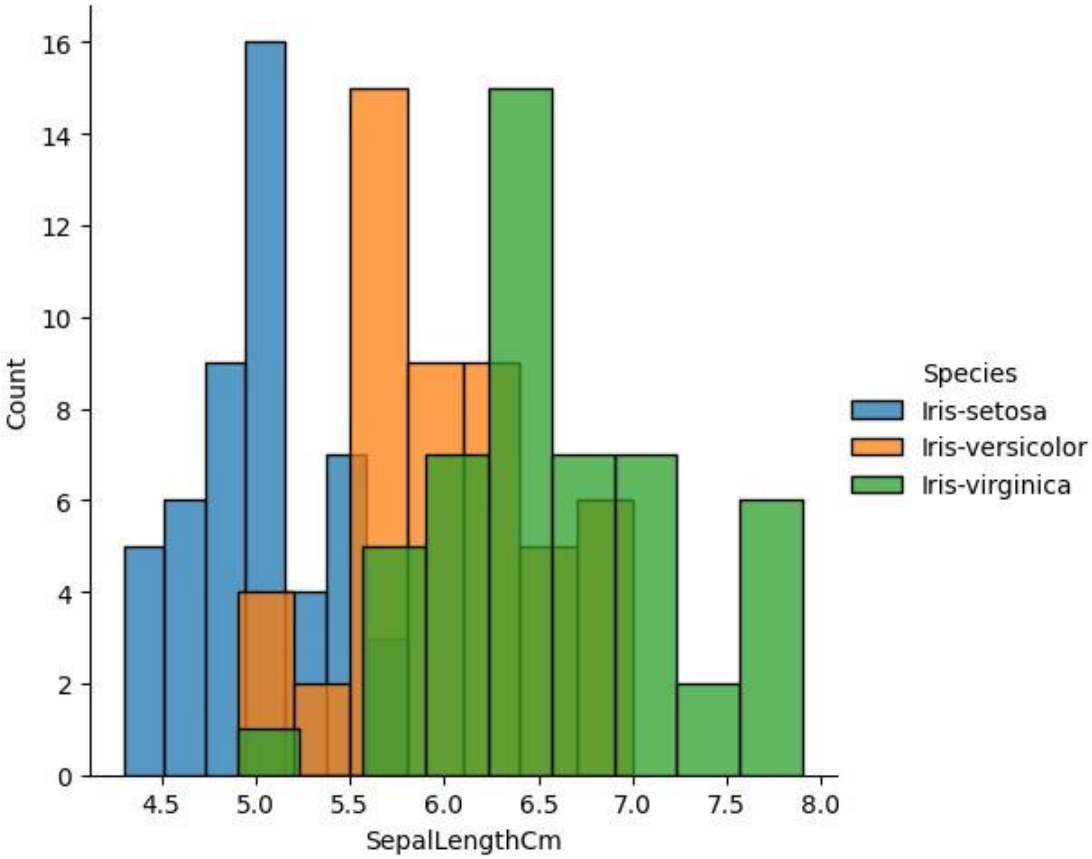
[15]:
```
sns.FacetGrid(data,hue='Species',height=5).map(sns.histplot,'PetalLengthCm').
  add_legend();
plt.show();
```



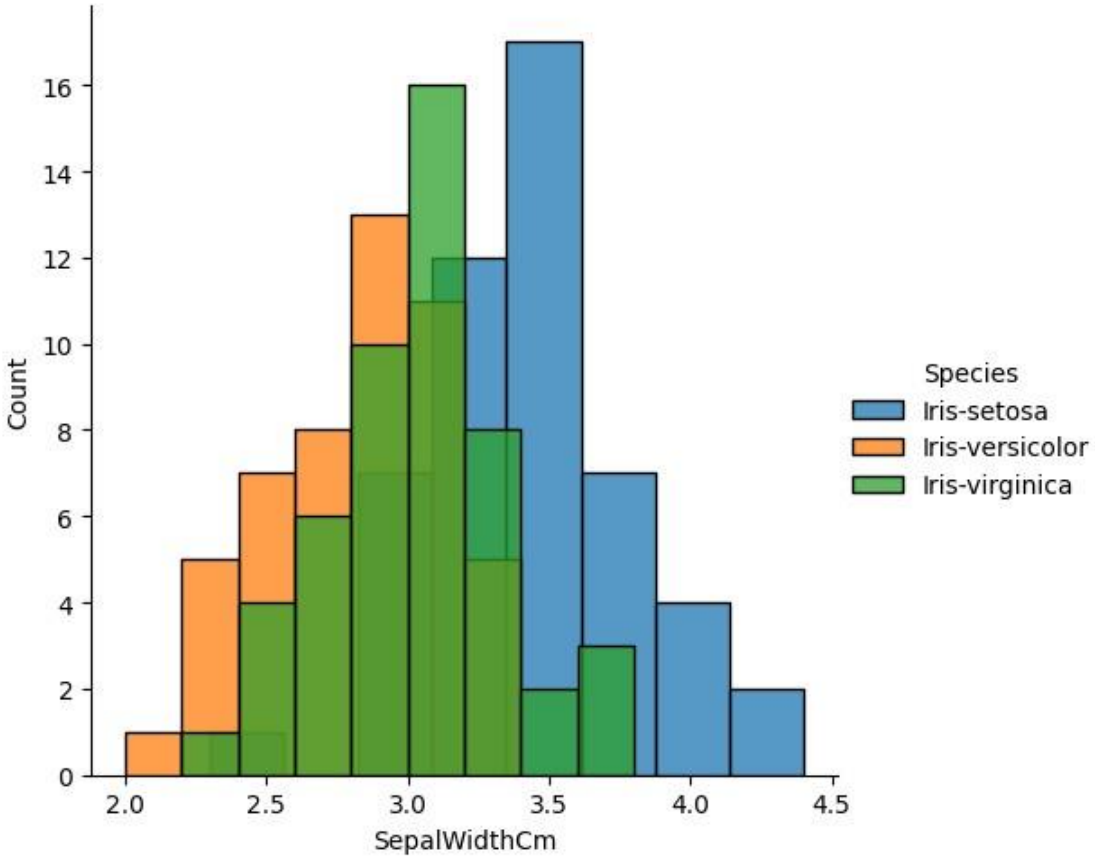
[16]:
```
sns.FacetGrid(data,hue='Species',height=5).map(sns.histplot,'PetalWidthCm').
  add_legend();
plt.show();
```



[17]:
```
sns.FacetGrid(data,hue='Species',height=5).map(sns.histplot,'SepalLengthCm').
  add_legend();
plt.show();
```



[18]:
```
sns.FacetGrid(data,hue='Species',height=5).map(sns.histplot,'SepalWidthCm').
  add_legend();
plt.show();
```



[ ]:

[ ]:
```
#EX.NO :1.b Pandas Buit in function. Numpy Buit in fuction- Array slicing,
 Ravel,Reshape,ndim
#DATA  :  06.08.2024

#NAME : KK SHYAAM
#ROLL NO : 230701313
#DEPARTMENT : B.E COMPUTER SCIENCE AND ENGINEERING - E
```

[20]:
```
import numpy as np
array=np.random.randint(1,100,9)
array
```

[20]:
```
array([39, 97, 88, 58, 29, 87, 27, 88, 91])
```

[21]:
```
np.sqrt(array)
```

[21]:
```
array([6.244998 , 9.8488578 , 9.38083152, 7.61577311, 5.38516481,
       9.32737905, 5.19615242, 9.38083152, 9.53939201])
```

```
[22]: array.ndim
```

```
[22]: 1
```

```
[23]: new_array=array.reshape(3,3)
```

```
[24]: new_array
```

```
[24]: array([[39, 97, 88],
             [58, 29, 87],
             [27, 88, 91]])
```

```
[25]: new_array.ndim
```

```
[25]: 2
```

```
[26]: new_array.ravel()
```

```
[26]: array([39, 97, 88, 58, 29, 87, 27, 88, 91])
```

```
[28]:
```

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

```

```

```
newm
```

```
[28]: array([[39, 97, 88],
             [58, 29, 87],
             [27, 88, 91]])
```

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

```
[29]: array([88, 91])
```

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

```
[30]: array([[29, 87]])
```

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

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

```
[32]: new_array[1:3]
```

```
[32]: array([[58, 29, 87],
             [27, 88, 91]])
```

[ ]:
```
#EX.NO :2 Outlier detection
#DATA  :  13.08.2024

#NAME : KK SHYAAM
#ROLL NO : 230701313
#DEPARTMENT : B.E COMPUTER SCIENCE AND ENGINEERING - E
```

[34]:
```
import numpy as np
import warnings
warnings.filterwarnings('ignore')
array=np.random.randint(1,100,16)
array
```

[34]:
```
array([37, 15, 49, 89, 30, 47, 2, 86, 53, 63, 41, 46, 42, 27, 5,
97])
```

[35]:
```
array.mean()
```

[35]:
```
45.5625
```

[36]:
```
np.percentile(array,25)
```

[36]:
```
29.25
```

[37]:
```
np.percentile(array,50)
```

[37]:
```
44.0
```

[38]:
```
np.percentile(array,75)
```

[38]:
```
55.5
```

[39]:
```
np.percentile(array,100)
```

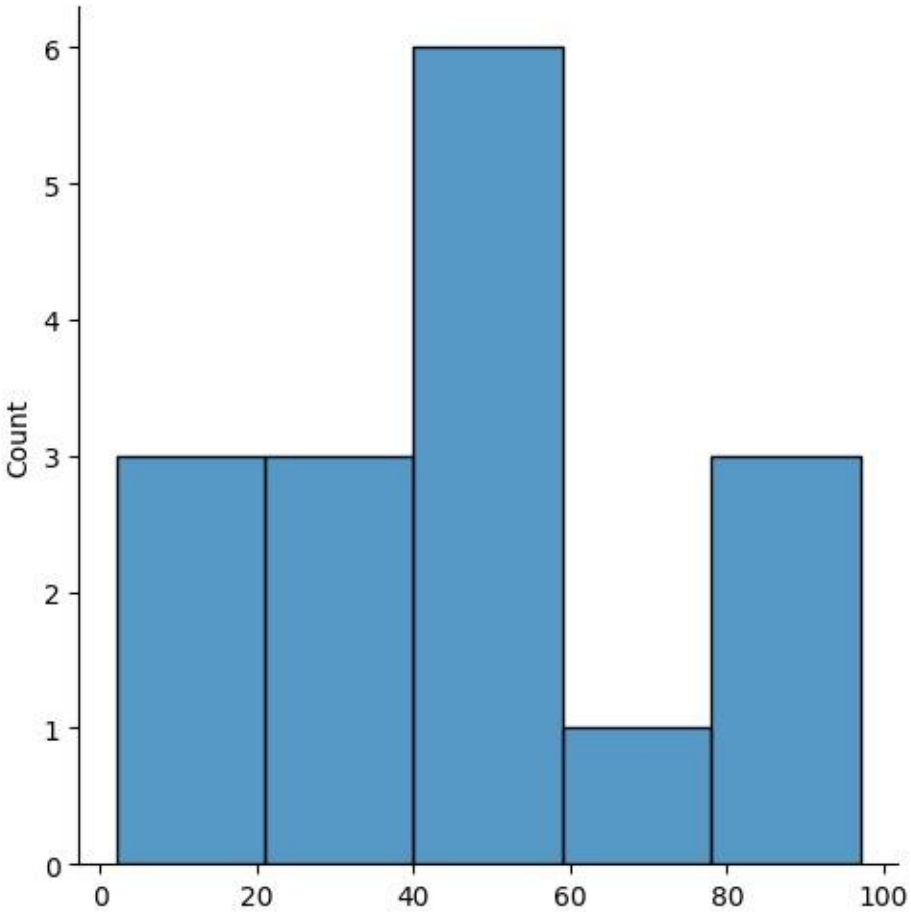
[39]:
```
97.0
```

[40]:
```
#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
```

[40]:
```
(-10.125, 94.875)
```

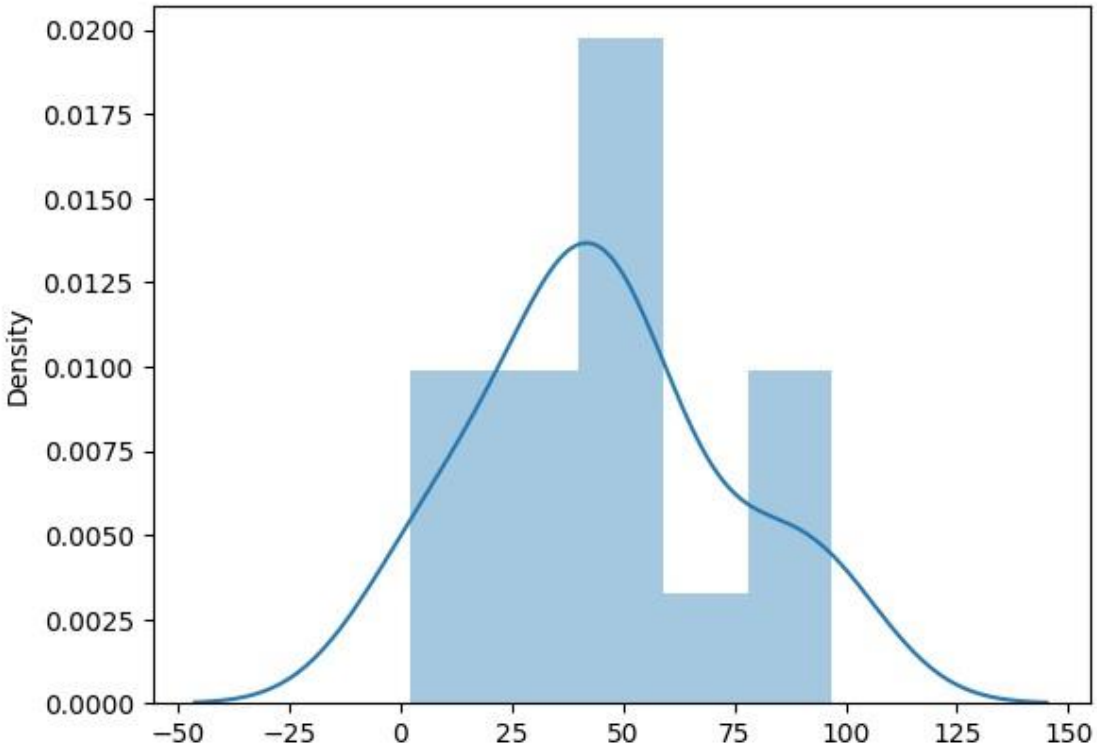
[41]:
```
import seaborn as sns
%matplotlib inline
sns.displot(array)
```

[41]: <seaborn.axisgrid.FacetGrid at 0x20d7cda3b50>



[42]:
```
sns.distplot(array)
```

[42]: <Axes: ylabel='Density'>

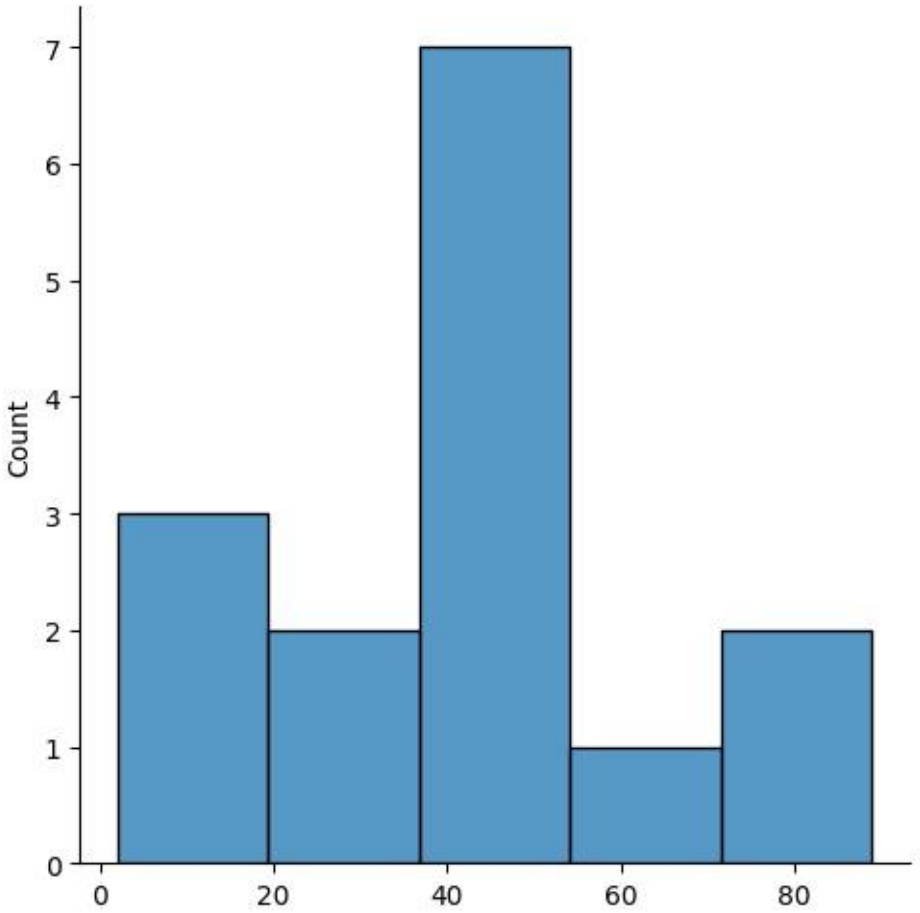


[43]:
```
new_array=array[(array>lr) & (array<ur)]
new_array
```

[43]:
```
array([37, 15, 49, 89, 30, 47, 2, 86, 53, 63, 41, 46, 42, 27, 5])
```

[44]:
```
sns.displot(new_array)
```

[44]:
```
<seaborn.axisgrid.FacetGrid at 0x20d7d02d950>
```



[45]:
```
lr1,ur1=outDetection(new_array)
lr1,ur1
```

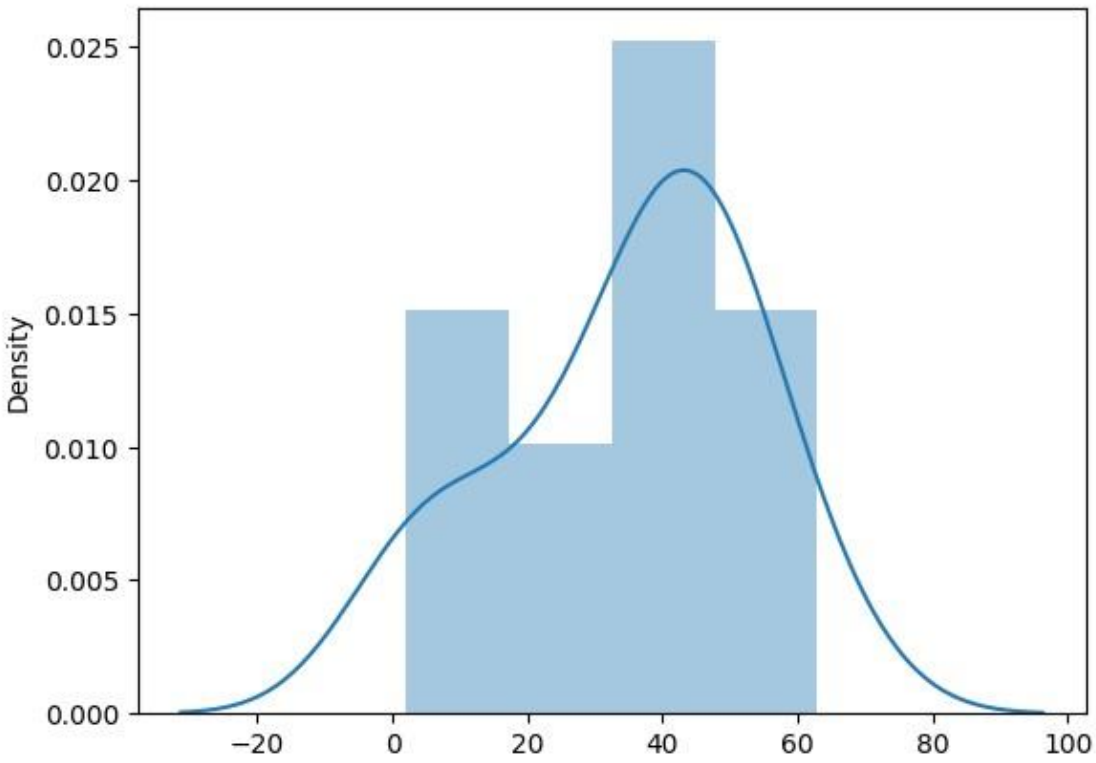
[45]: (-5.25, 84.75)

[46]:
```
final_array=new_array[(new_array>lr1) & (new_array<ur1)]
final_array
```

[46]: array([37, 15, 49, 30, 47, 2, 53, 63, 41, 46, 42, 27, 5])

[47]:
```
sns.distplot(final_array)
```

[47]: <Axes: ylabel='Density'>



[ ]:
```
#EX.NO :3  Missing and inappropriate data
#DATA  :  20.08.2024

#NAME : KK SHYAAM
#ROLL NO : 230701313
#DEPARTMENT : B.E COMPUTER SCIENCE AND ENGINEERING - E
```

[49]:
```
import numpy as np
import pandas as pd
import warnings
warnings.filterwarnings('ignore')
df=pd.read_csv("Hotel_Dataset.csv")
df
```

[49]:

	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
```

[50]:
```
df.duplicated()
```

[50]:
```
0   False
1    False
2    False
3    False
4    False
5    False
6    False
7    False
8    False
9     True
10   False
dtype: bool
```

[51]:
```
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
```

[52]:
```
df.drop_duplicates(inplace=True)
df
```

[52]:

	CustomerID	Age_Group	Rating(1-5)	Hotel	FoodPreference	Bill	NoOfPax	EstimatedSalary	Age_Group.1
0	1	20-25	4	Ibis	veg	1300	2	40000	20-25
1	2	30-35	5	LemonTree	Non-Veg	2000	3	59000	30-35
2	3	25-30	6	RedFox	Veg	1322	2	30000	25-30
3	4	20-25	-1	LemonTree	Veg	1234	2	120000	20-25
4	5	35+	3	Ibis	Vegetarian	989	2	45000	35+
5	6	35+	3	Ibys	Non-Veg	1909	2	122220	35+
6	7	35+	4	RedFox	Vegetarian	1000	-1	21122	35+
7	8	20-25	7	LemonTree	Veg	2999	-10	345673	20-25
8	9	25-30	2	Ibis	Non-Veg	3456	3	-99999	25-30
10	10	30-35	5	RedFox	non-Veg	-6755	4	87777	30-35

[53]:
```
len(df)
```

[53]: 10

[54]:
```
index=np.array(list(range(0,len(df))))
df.set_index(index,inplace=True)
index
```

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

[55]:
```
df
```

[55]:
```
  CustomerID Age_Group Rating(1-5)  Hotel FoodPreference Bill NoOfPax \
0          1     20-25 4     Ibis  veg 1300   2
1          2     30-35 5 LemonTree     Non-Veg 2000     3
2          3     25-30 6     RedFox     Veg 1322   2
3          4     20-25 -1 LemonTree     Veg 1234   2
4          5     35+   3     Ibis  Vegetarian 989   2
5          6     35+   3     Ibys  Non-Veg 1909     2
6          7 35+ 4 RedFox Vegetarian 1000 -1 7 8 20-25 7 LemonTree
           Veg 2999 -10 8 9 25-30 2 Ibis Non-Veg 3456 3
9         10    30-35           5    RedFox      non-Veg -6755      4

   EstimatedSalary Age_Group.1
0           40000     20-25
1           59000     30-35
2           30000     25-30
3           120000    20-25
4           45000     35+
5           122220    35+
6           21122     35+
7           345673    20-25
8           -99999    25-30
9           87777     30-35
```

[56]:
```
df.drop(['Age_Group.1'],axis=1,inplace=True)
df
```

[56]:
```
   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
```

[57]:
```
df.CustomerID.loc[df.CustomerID<0]=np.nan
df.Bill.loc[df.Bill<0]=np.nan
df.EstimatedSalary.loc[df.EstimatedSalary<0]=np.nan
df
```

[57]:
```
   CustomerID Age_Group  Rating(1-5)      Hotel FoodPreference    Bill  \
0         1.0    20-25 4     Ibis  veg 1300.0
1         2.0    30-35 5 LemonTree      Non-Veg 2000.0
2         3.0    25-30 6     RedFox     Veg 1322.0
3         4.0    20-25 -1 LemonTree     Veg 1234.0
4         5.0    35+   3     Ibis  Vegetarian 989.0
5         6.0    35+   3     Ibys  Non-Veg 1909.0
6         7.0    35+   4     RedFox     Vegetarian 1000.0
7         8.0 20-25 7 LemonTree Veg 2999.0 8 9.0 25-30 2 Ibis Non-Veg
          3456.0
9        10.0    30-35          5    RedFox      non-Veg    NaN

   NoOfPax EstimatedSalary
0       2  40000.0
1       3  59000.0
2       2 30000.0 3 2 120000.0
4 2 45000.0 5 2 122220.0
6 -1 21122.0 7 -10
345673.0
8       3  NaN
9       4  87777.0
```

[58]:
```
df['NoOfPax'].loc[(df['NoOfPax']<1) | (df['NoOfPax']>20)]=np.nan
df
```

[58]:
```
   CustomerID Age_Group Rating(1-5) Hotel FoodPreference  Bill \
0         1.0    20-25         4       Ibis          veg 1300.0
1         2.0    30-35          5 LemonTree      Non-Veg 2000.0
2         3.0    25-30         6     RedFox          Veg 1322.0
3         4.0    20-25         -1 LemonTree          Veg 1234.0
4         5.0      35+         3       Ibis    Vegetarian 989.0
5         6.0      35+         3       Ibys      Non-Veg 1909.0
6         7.0      35+         4     RedFox    Vegetarian 1000.0
7         8.0    20-25          7 LemonTree          Veg 2999.0
8         9.0    25-30         2       Ibis      Non-Veg 3456.0
9        10.0    30-35         5     RedFox      non-Veg    NaN
   NoOfPax EstimatedSalary
0      2.0  40000.0
```

```
1     3.0 59000.0
2     2.0       30000.0
3     2.0      120000.0
4     2.0       45000.0
5     2.0      122220.0
6     NaN       21122.0
7     NaN      345673.0
8     3.0           NaN
9     4.0       87777.0
```

[59]:
```
df.Age_Group.unique()
```

[59]:
```
array(['20-25', '30-35', '25-30', '35+'], dtype=object)
```

[60]:
```
df.Hotel.unique()
```

[60]:
```
array(['Ibis', 'LemonTree', 'RedFox', 'Ibys'], dtype=object)
```

[61]:
```
df.Hotel.replace(['Ibys'],'Ibis',inplace=True)
df.FoodPreference.unique
```

[61]:
```
<bound method Series.unique of 0      veg
1          Non-Veg
2          Veg
3          Veg
4          Vegetarian
5          Non-Veg
6          Vegetarian
7          Veg
8          Non-Veg
9          non-Veg
Name: FoodPreference, dtype: object>
```

[62]:
```
df.FoodPreference.replace(['Vegetarian','veg'],'Veg',inplace=True)
df.FoodPreference.replace(['non-Veg'],'Non-Veg',inplace=True)
```

[63]:
```
df.EstimatedSalary.fillna(round(df.EstimatedSalary.mean()),inpl
ace=True)
df.NoOfPax.fillna(round(df.NoOfPax.median()),inplace=True)
df['Rating(1-5)'].fillna(round(df['Rating(1-5)'].median()),
inplace=True)
df.Bill.fillna(round(df.Bill.mean()),inplace=True) df
```

[63]:
```
 CustomerID Age_Group Rating(1-5)  Hotel FoodPreference  Bill \
0        1.0    20-25 4     Ibis  Veg 1300.0
1        2.0    30-35 5 LemonTree      Non-Veg 2000.0
2        3.0    25-30 6     RedFox     Veg 1322.0
```

```
3        4.0    20-25 -1 LemonTree     Veg 1234.0
4        5.0    35+   3     Ibis  Veg   989.0
5        6.0    35+   3     Ibis  Non-Veg 1909.0
6        7.0    35+   4     RedFox     Veg 1000.0
7        8.0 20-25 7 LemonTree Veg 2999.0 8 9.0 25-30 2 Ibis Non-Veg
         3456.0
9       10.0    30-35          5    RedFox      Non-Veg 1801.0

   NoOfPax EstimatedSalary
0    2.0   40000.0 1  3.0
     59000.0 2  2.0
     30000.0
3     2.0 120000.0
4     2.0 45000.0
5     2.0 122220.0
6     2.0 21122.0 7 2.0 345673.0
8     3.0         96755.0
9     4.0          87777.0
```

[ ]:
```
#EX.NO :4  Data Preprocessing
#DATA  :  27.08.2024

#NAME : KK SHYAAM
#ROLL NO : 230701313
#DEPARTMENT : B.E COMPUTER SCIENCE AND ENGINEERING - E
```

[65]:
```
import numpy as np
import pandas as pd
import warnings
warnings.filterwarnings('ignore')
df=pd.read_csv("pre_process_datasample.csv")
df
```

[65]:
```
   Country   Age   Salary Purchased
0   France 44.0 72000.0       No
1    Spain 27.0 48000.0      Yes
2 Germany 30.0 54000.0       No
3    Spain 38.0 61000.0       No
4 Germany 40.0     NaN      Yes
5   France 35.0 58000.0      Yes
6    Spain  NaN 52000.0       No
7   France 48.0 79000.0      Yes
8 Germany 50.0 83000.0       No
9   France 37.0 67000.0      Yes
```

[66]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 10 entries, 0 to
9 Data columns (total 4
columns):
 #   Column    Non-Null Count Dtype
--- ------ -------------- ----0
     Country    10 non-null
     object
 1   Age    9 non-null float64
 2   Salary 9 non-null float64
 3   Purchased 10 non-null  object
dtypes: float64(2), object(2)
memory usage: 452.0+ bytes
```

[67]:
```
df.Country.mode()
```

[67]:
```
0    France
Name: Country, dtype: object
```

[68]:
```
df.Country.mode()[0]
```

[68]:
```
'France'
```

[69]:
```
type(df.Country.mode())
```

[69]:
```
pandas.core.series.Series
```

[70]:
```
df.Country.fillna(df.Country.mode()[0],inplace=T
rue) df.Age.fillna(df.Age.median(),inplace=True)
df.Salary.fillna(round(df.Salary.mean()),inplace
=True) df
```

[70]:

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

[71]:
```
pd.get_dummies(df.Country)
```

[71]:
```
France Germany Spain 0
     True  False False
```

```
1   False  False True
2   False  True False
3   False   False  True
4   False    True
             False
5    True   False
            False
6   False   False  True
7    True   False
            False
8   False    True
             False
9    True    False  False
```

[72]:
```
updated_dataset=pd.concat([pd.get_dummies(df.Country),df.iloc[:
 ,[1,2,3]]],axis=1)
```

[73]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 10 entries, 0 to
9 Data columns (total 4
columns):
 #   Column    Non-Null Count Dtype
--- ------ -------------- ----0
 Country 10 non-null object
 1 Age 10 non-null float64 2
 Salary 10 non-null float64
 3  Purchased 10 non-null   object
dtypes: float64(2), object(2)
```

```
memory usage: 452.0+ bytes
```

[74]:
```
updated_dataset.Purchased.replace(['No','Yes'],[0,1],inplace=True)
```

[ ]:
```
#EX.NO :5  EDA-Quantitative and Qualitative plots
#DATA  :  27.08.2024

#NAME : KK SHYAAM
#ROLL NO : 230701313
#DEPARTMENT : B.E COMPUTER SCIENCE AND ENGINEERING - E
```

[76]:
```
import numpy as np
import pandas as pd
import warnings
warnings.filterwarnings('ignore')
df=pd.read_csv("pre_process_datasample.csv")
df
```

[76]:

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

[77]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 10 entries, 0 to
9 Data columns (total 4
columns):
 #   Column    Non-Null Count Dtype
--- ------ -------------- ----0
     Country    10 non-null
     object
 1   Age    9 non-null float64
 2   Salary 9 non-null float64
 3   Purchased 10 non-null  object
dtypes: float64(2), object(2)
memory usage: 452.0+ bytes
```

[78]:
```
df.Country.mode()
```

[78]:
```
0    France
Name: Country, dtype: object
```

[79]:
```
df.Country.mode()[0]
```

[79]:
```
'France'
```

[80]:
```
type(df.Country.mode())
```

[80]:
```
pandas.core.series.Series
```

[81]:
```
df.Country.fillna(df.Country.mode()[0],inplace=T
rue) df.Age.fillna(df.Age.median(),inplace=True)
df.Salary.fillna(round(df.Salary.mean()),inplace
=True) df
```

[81]:

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

[82]:
```
pd.get_dummies(df.Country)
```

[82]:

	France	Germany	Spain
0	True	False	False
1	False	False	True
2	False	True	False
3	False	False	True
4	False	True	False
5	True	False	False
6	False	False	True
7	True	False	False
8	False	True	False
9	True	False	False

[83]:
```
updated_dataset=pd.concat([pd.get_dummies(df.Country),df.iloc[:
 ,[1,2,3]]],axis=1)
updated_dataset
```

[83]:

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

[84]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 10 entries, 0 to
9 Data columns (total 4
columns):
#   Column    Non-Null Count
              Dtype
--- ------    -------------- ----
              -
0   Country   10 non-null   object
1   Age       10 non-null  float64
2   Salary    10 non-null  float64
 3  Purchased 10 non-null   object
dtypes: float64(2), object(2)
memory usage: 452.0+ bytes
```

[85]:
```
updated_dataset
```

[85]:

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

```
9    True    False  False  37.0  67000.0       Yes
```

[ ]:
```
#EX.NO :5  EDA-Quantitative and Qualitative plots
#DATA  : 03.09.2024

#NAME : KK SHYAAM
#ROLL NO : 230701313
#DEPARTMENT : B.E COMPUTER SCIENCE AND ENGINEERING - E
```

[87]:
```
import seaborn as sns
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
%matplotlib inline
```

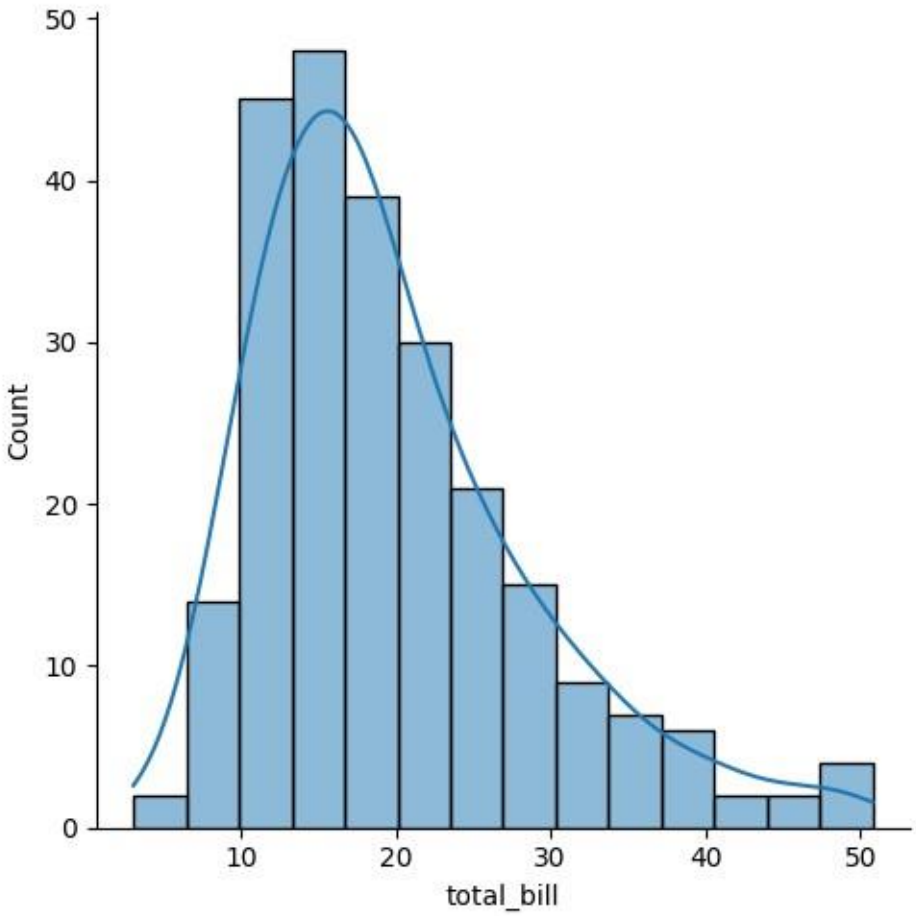
[88]:
```
tips=sns.load_dataset('tips')
tips.head()
```

[88]:

	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

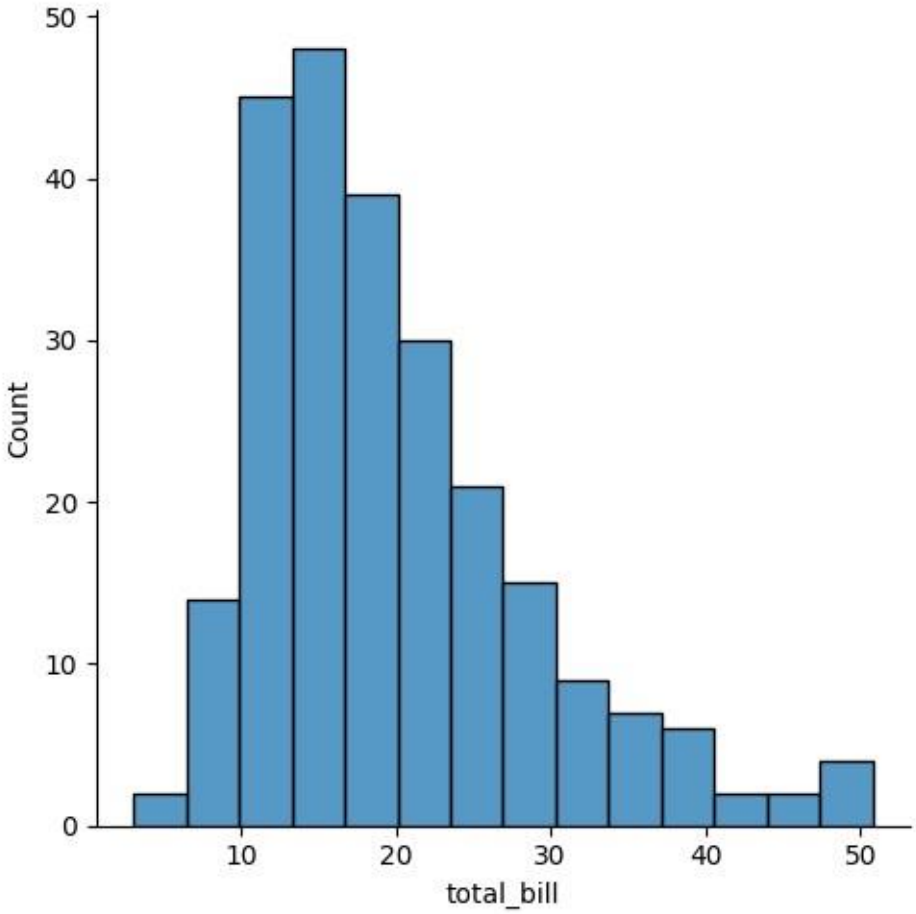
[89]:
```
sns.displot(tips.total_bill,kde=True)
```

[89]:
```
<seaborn.axisgrid.FacetGrid at 0x20d7dc69390>
```



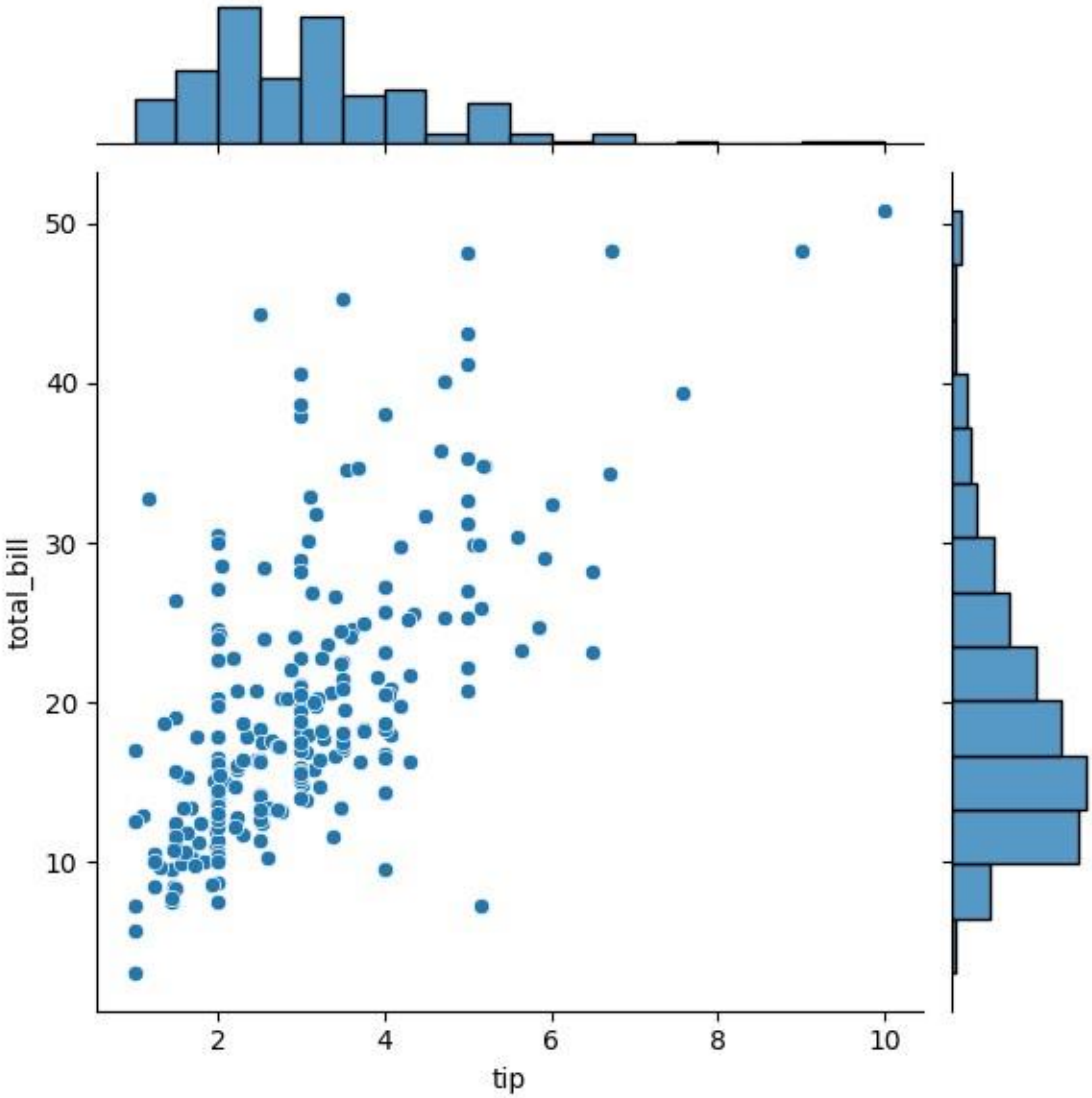
[90]:
```
sns.displot(tips.total_bill,kde=False)
```

[90]: <seaborn.axisgrid.FacetGrid at 0x20d7dc22790>



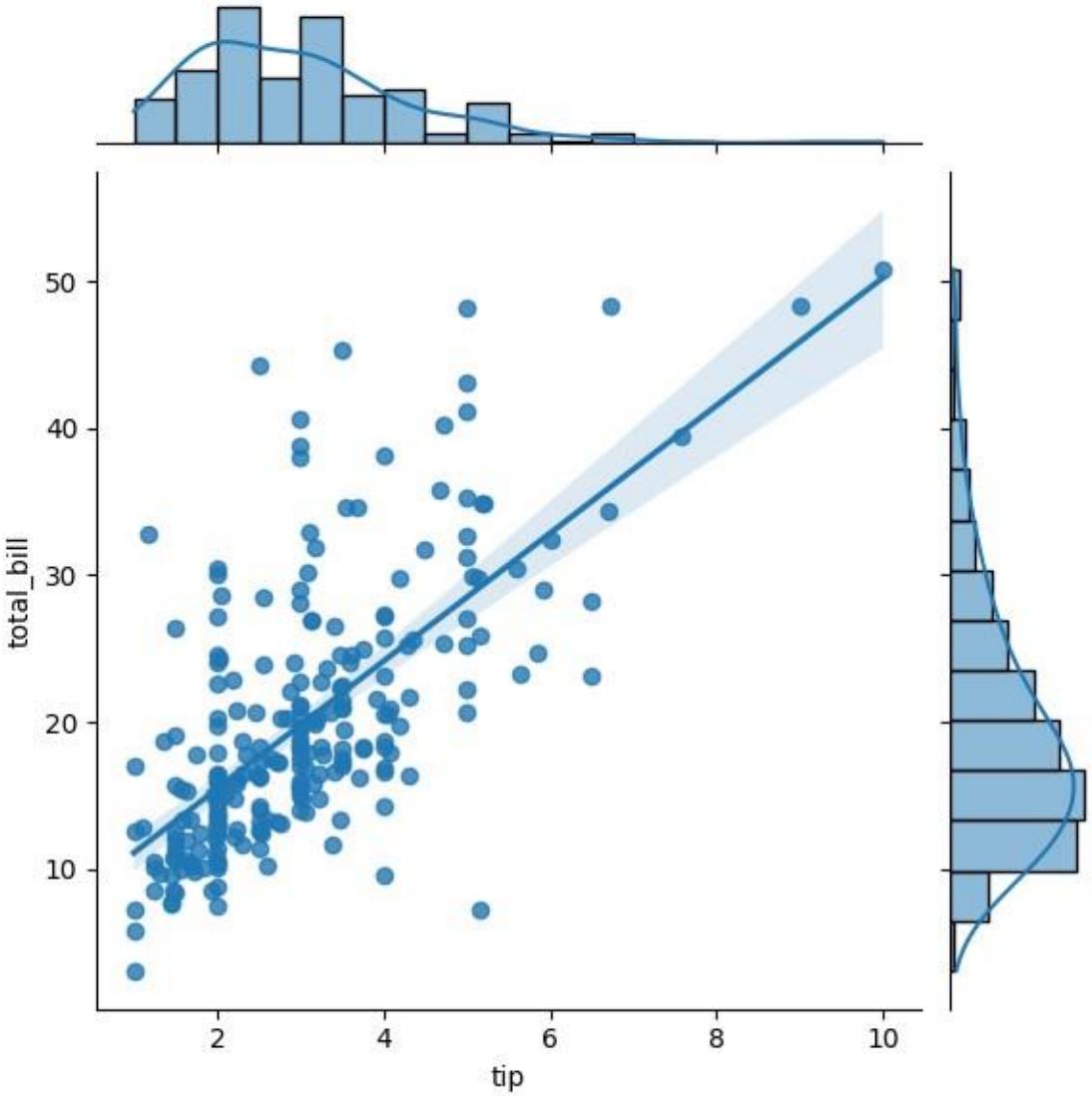
[91]:
```
sns.jointplot(x=tips.tip,y=tips.total_bill)
```

[91]: <seaborn.axisgrid.JointGrid at 0x20d7dc2f2d0>



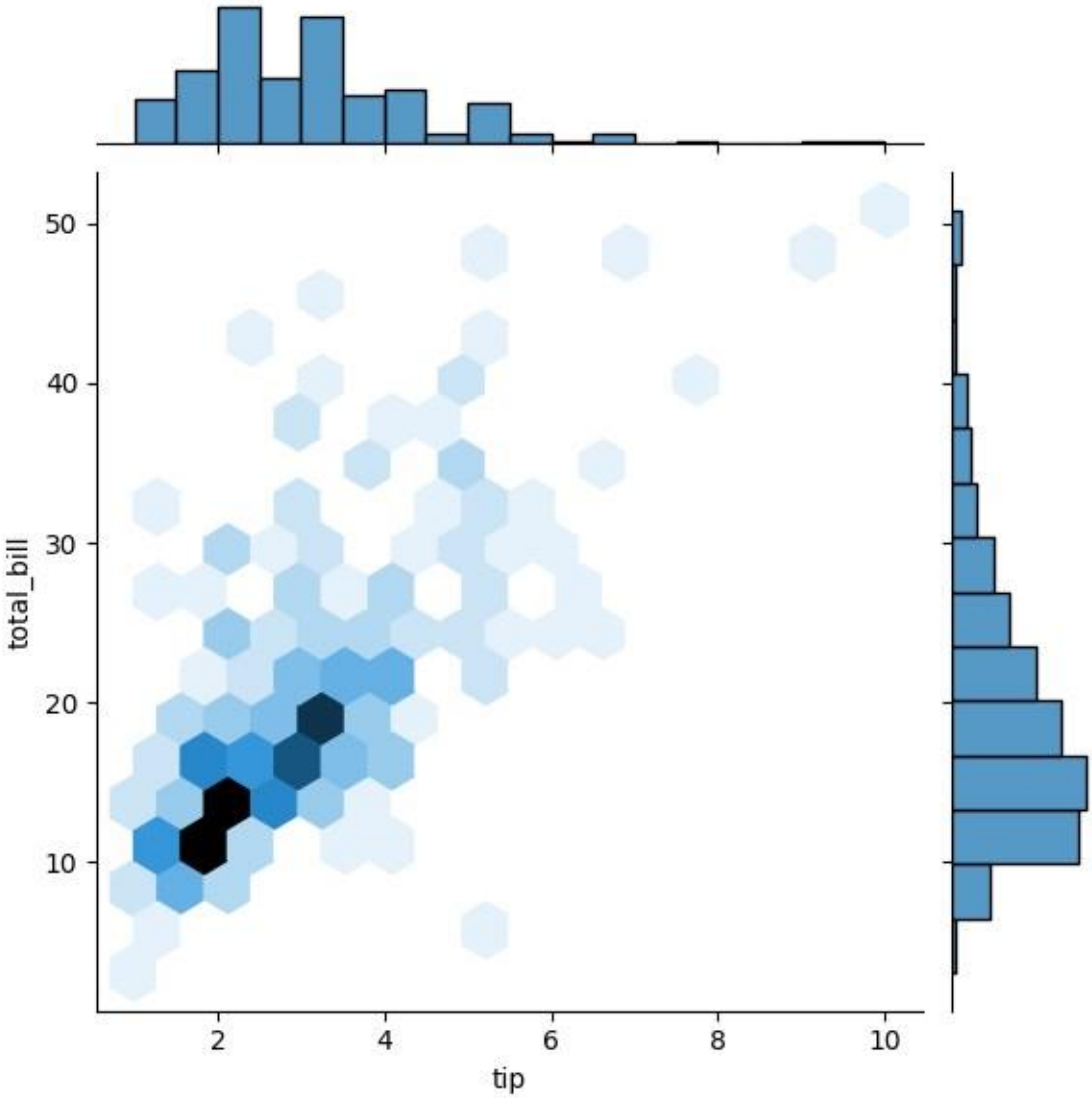
[92]:
```
sns.jointplot(x=tips.tip,y=tips.total_bill,kind="reg")
```

[92]: <seaborn.axisgrid.JointGrid at 0x20d7ed32450>



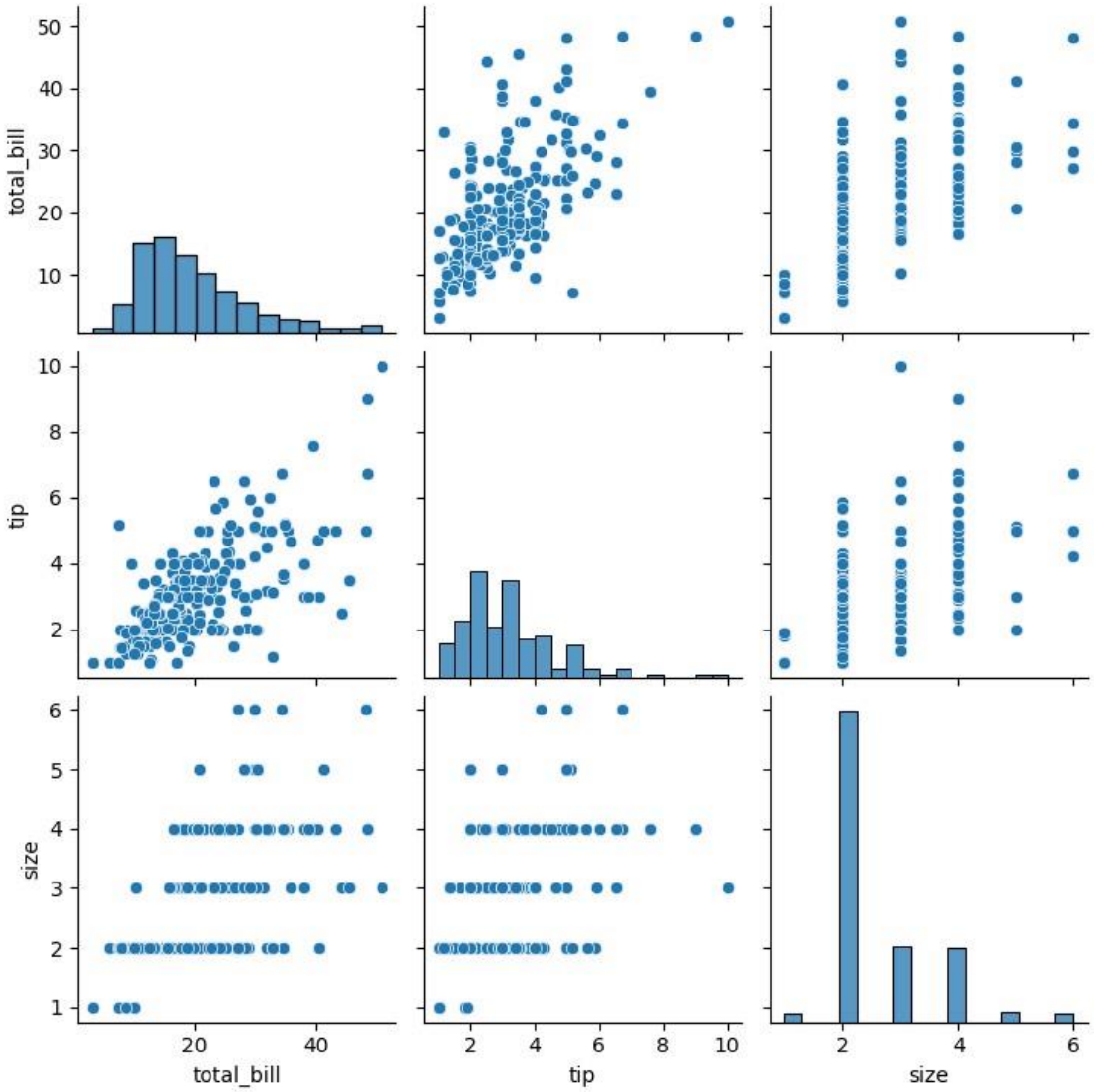
[93]:
```
sns.jointplot(x=tips.tip,y=tips.total_bill,kind="hex")
```

[93]: <seaborn.axisgrid.JointGrid at 0x20d7ed7d350>



[94]:
```
sns.pairplot(tips)
```

[94]: <seaborn.axisgrid.PairGrid at 0x20d7f1c9cd0>

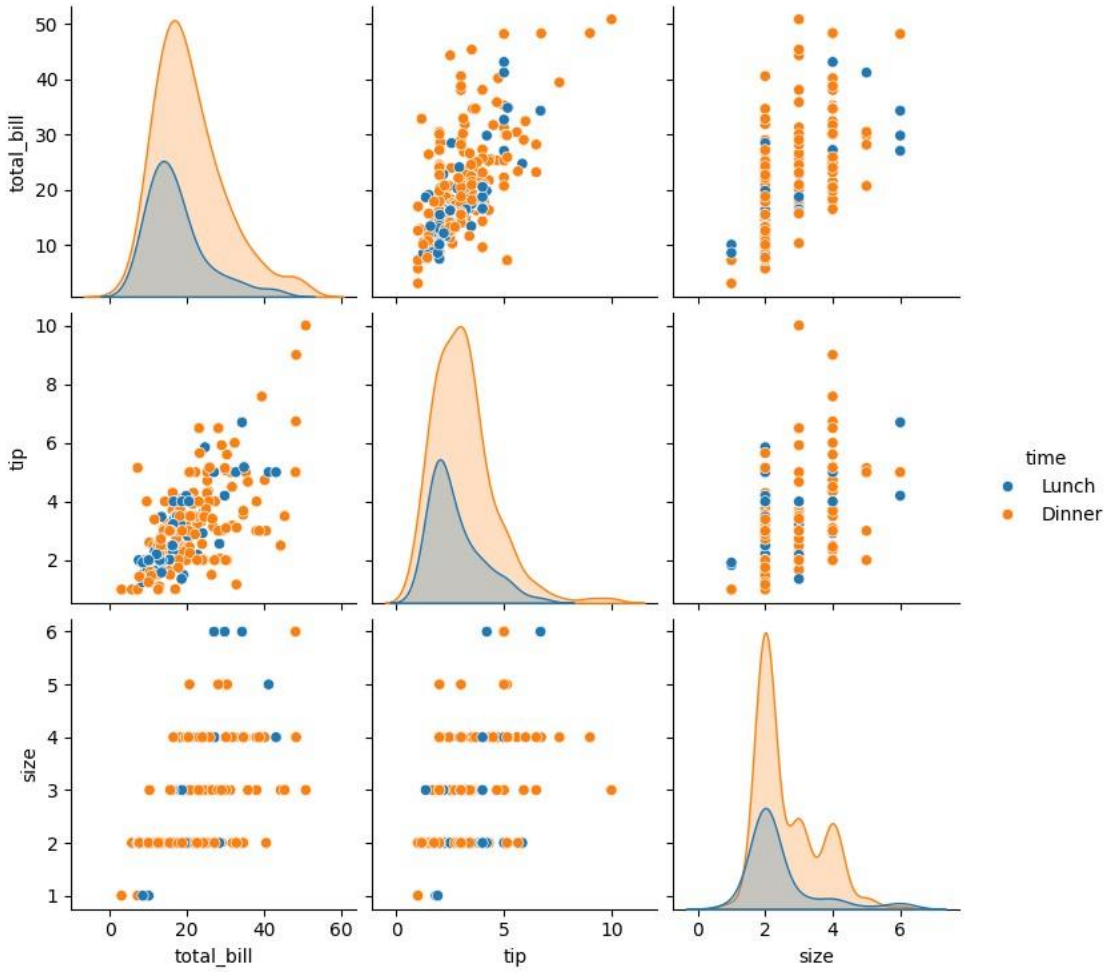


[95]:
```
tips.time.value_counts()
```

[95]:
```
time
Dinner    176
Lunch      68
Name: count, dtype: int64
```

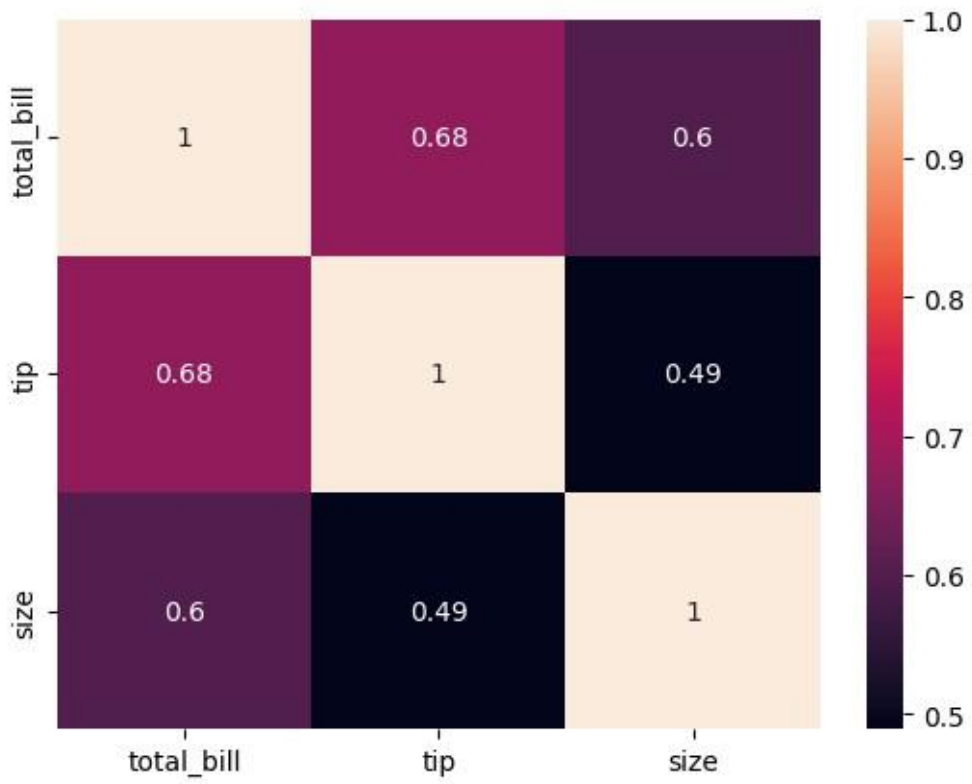
[96]:
```
sns.pairplot(tips,hue='time')
```

[96]:
```
<seaborn.axisgrid.PairGrid at 0x20d7cc27990>
```



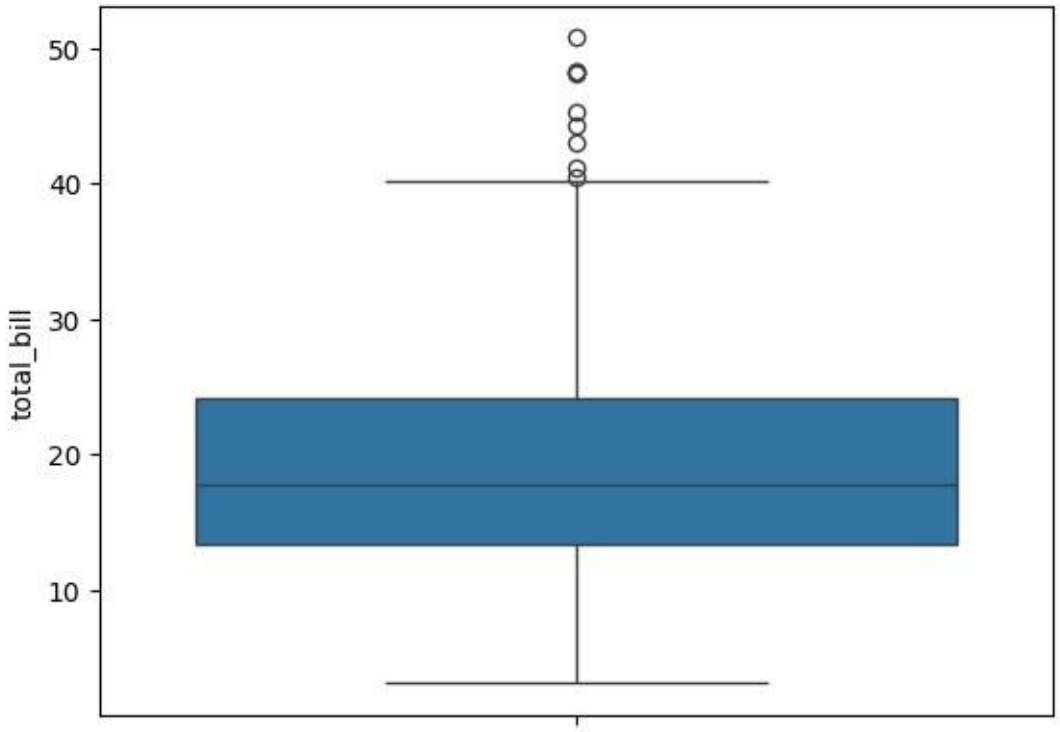
[97]:
```
sns.heatmap(tips.corr(numeric_only=True),annot=True)
```

[97]: <Axes: >



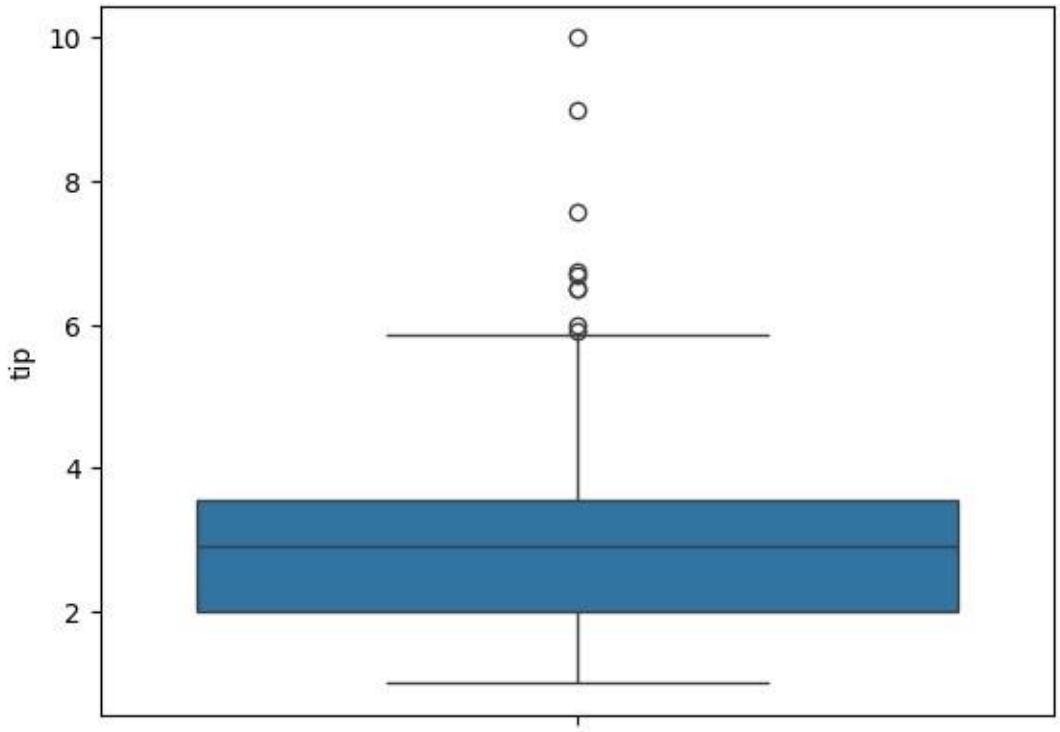
[98]:
```
sns.boxplot(tips.total_bill)
```

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



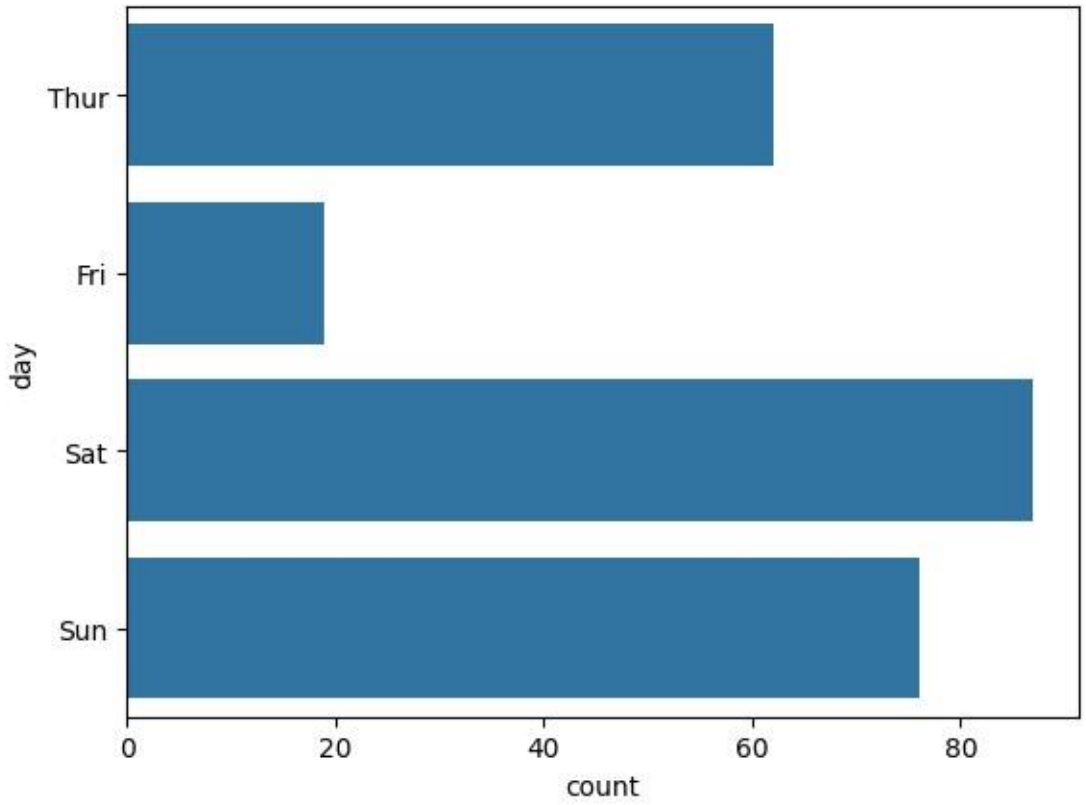
[99]:
```
sns.boxplot(tips.tip)
```

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



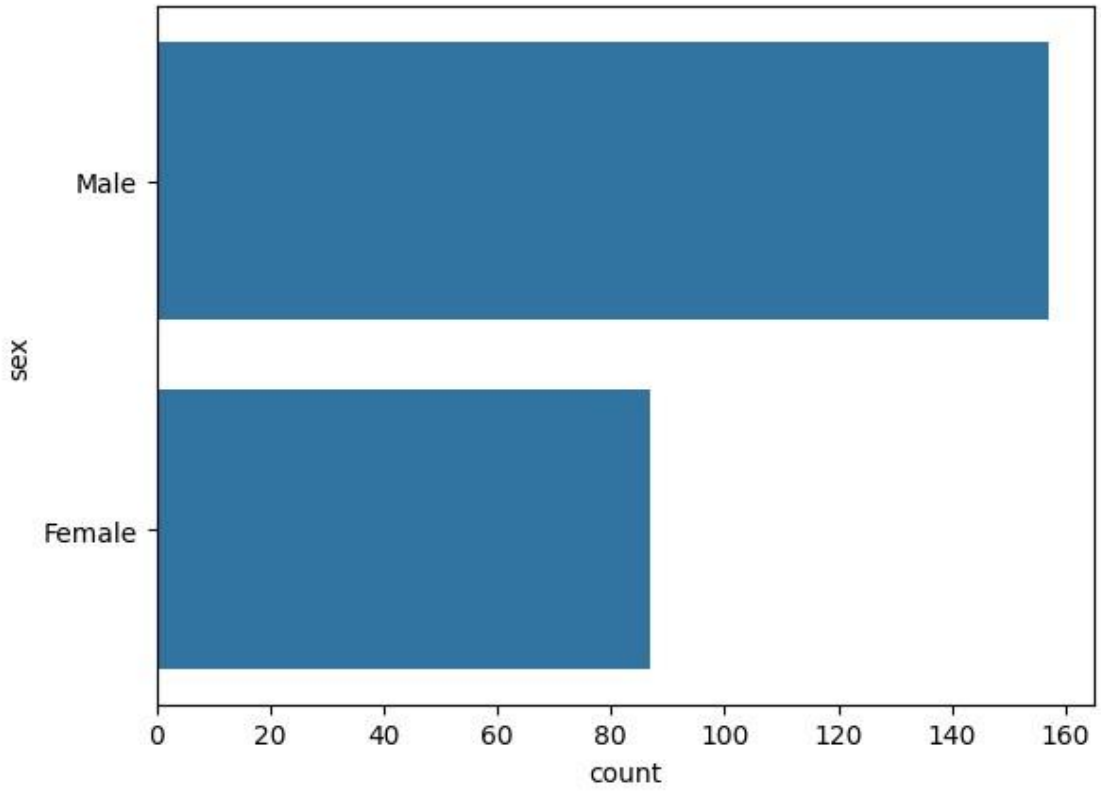
[100]:
```
sns.countplot(tips.day)
```

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



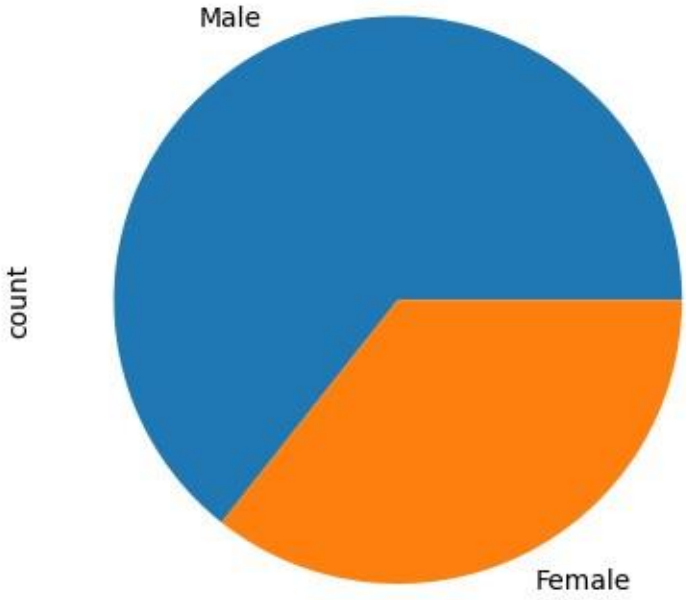
[101]:
```
sns.countplot(tips.sex)
```

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



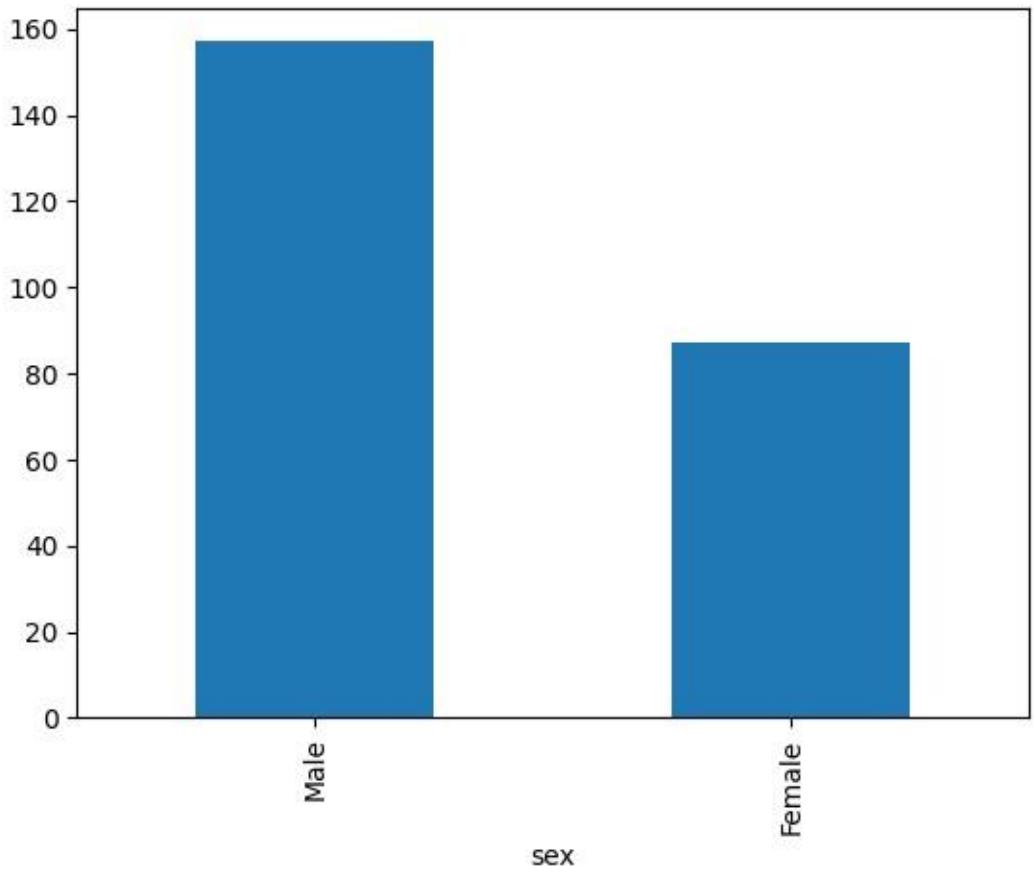
[102]:
```
tips.sex.value_counts().plot(kind='pie')
```

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



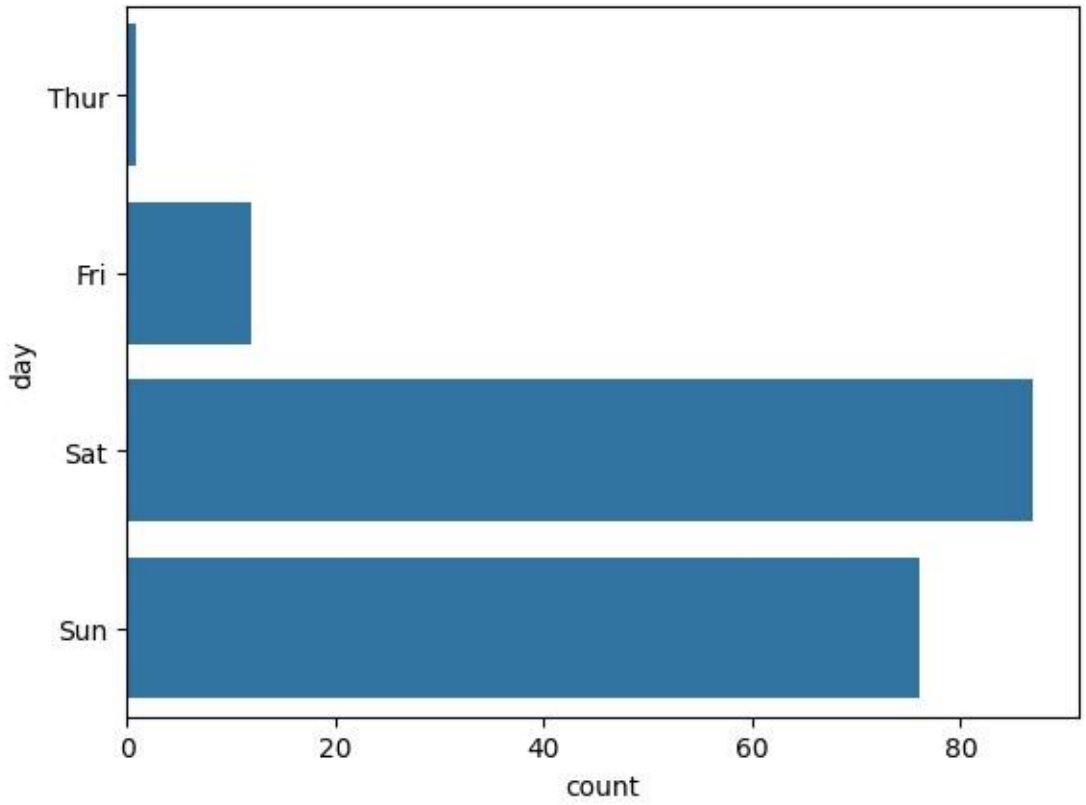
[103]:
```
tips.sex.value_counts().plot(kind='bar')
```

[103]: <Axes: xlabel='sex'>



[104]:
```
sns.countplot(tips[tips.time=='Dinner']['day'])
```

[104]:
```
<Axes: xlabel='count', ylabel='day'>
```



[ ]:
```
#EX.NO :6  Random Sampling and Sampling Distribution
#DATA  : 10.09.2024

#NAME : KK SHYAAM
#ROLL NO : 230701313
#DEPARTMENT : B.E COMPUTER SCIENCE AND ENGINEERING - E
```

[106]:
```
import numpy as np
import matplotlib.pyplot as plt
```

[107]:
```
population_mean = 50
population_std = 10
population_size = 100000
population = np.random.normal(population_mean, population_std, population_size)
```

[108]:
```
sample_sizes = [30, 50, 100]
num_samples = 1000
```

[109]:
```
sample_means = {}
for size in sample_sizes:
   sample_means[size] = []
```

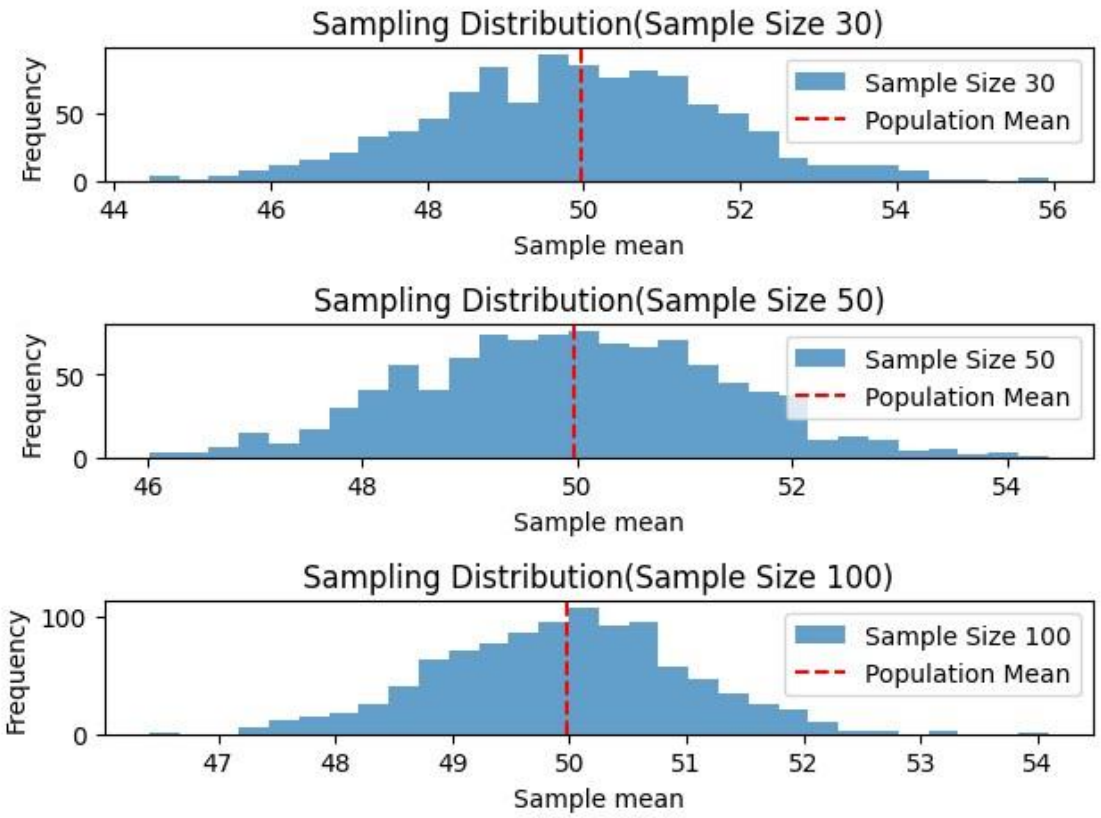
```
    for _ in range(num_samples):
        sample = np.random.choice(population, size=size, replace=False)
        sample_means[size].append(np.mean(sample))
```

[110]:
```
plt.figure(figsize=(12, 8))
```

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

<Figure size 1200x800 with 0 Axes >

[111]:
```
for i, size in enumerate(sample_sizes):
    plt.subplot(len(sample_sizes), 1,  +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()
```



[ ]:
```
#EX.NO :7  Z-Test
#DATA  : 10.09.2024

#NAME : PRASANNA KUMAR M
#ROLL NO : 230701237
#DEPARTMENT : B.E COMPUTER SCIENCE AND ENGINEERING - D
```

[113]:
```
import numpy as np
import scipy.stats as stats
```

[114]:
```
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])
```

[115]:
```
population_mean = 150
sample_mean = np.mean(sample_data)
sample_std = np.std(sample_data, ddof=1)
```

[116]:
```
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)))
```

[117]:
```
# Assuming sample_mean, z_statistic, and p_value have already been calculated:
print(f"Sample Mean: {sample_mean:.2f}\n")
print(f"Z-Statistic: {z_statistic:.4f}\n")
print(f"P-Value: {p_value:.4f}\n")

# Significance level
alpha = 0.05

# Decision based on p-value
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.")
```

```
Sample Mean: 150.20

Z-Statistic: 0.6406

P-Value: 0.5218

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

[ ]:
```
#EX.NO :8  T-Test
#DATA  : 08.10.2024

#NAME : KK SHYAAM
#ROLL NO : 230701313
#DEPARTMENT : B.E COMPUTER SCIENCE AND ENGINEERING - E
```

[119]:
```
import numpy as np
import scipy.stats as stats
np.random.seed(42)
sample_size = 25
sample_data = np.random.normal(loc=102, scale=15, size=sample_size)
```

[120]:
```
population_mean = 100
sample_mean = np.mean(sample_data)
sample_std = np.std(sample_data, ddof=1)
```

[121]:
```
n = len(sample_data)
t_statistic, p_value = stats.ttest_1samp(sample_data,population_mean)
```

[122]:
```
# Assuming sample_mean, t_statistic, and p_value have already been calculated:
print(f"Sample Mean: {sample_mean:.2f}\n")
print(f"T-Statistic: {t_statistic:.4f}\n")
print(f"P-Value: {p_value:.4f}\n")

# Significance level
alpha = 0.05

# Decision based on p-value
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 IQ score from 100. ")
```

```
Sample Mean: 99.55

T-Statistic: -0.1577

P-Value: 0.8760

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

[ ]:
```
#EX.NO :9  Annova TEST
#DATA  : 08.10.2024
```

```
#NAME : PRASANNA KUMAR M
#ROLL NO : 230701237
#DEPARTMENT : B.E COMPUTER SCIENCE AND ENGINEERING - D
```

[124]:
```
import numpy as np
import scipy.stats as stats
from statsmodels.stats.multicomp import pairwise_tukeyhsd

np.random.seed(42)
n_plants = 25
```

[125]:
```
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)
```

[126]:
```
all_data = np.concatenate([growth_A, growth_B, growth_C])
```

[127]:
```
treatment_labels = ['A'] * n_plants + ['B'] * n_plants + ['C'] * n_plants
f_statistic, p_value = stats.f_oneway(growth_A, growth_B, growth_C)
```

[128]:
```
mean_A = np.mean(growth_A)
mean_B = np.mean(growth_B)
mean_C = np.mean(growth_C)
print(f"Treatment A Mean Growth: {mean_A:.4f}")
print(f"Treatment B Mean Growth: {mean_B:.4f}")
print(f"Treatment C Mean Growth: {mean_C:.4f}")
print(f"F-Statistic: {f_statistic:.4f}")
print(f"P-Value: {p_value:.4f}")

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.")


if p_value < alpha:

    tukey_results = pairwise_tukeyhsd(all_data, treatment_labels, alpha=0.05)

    print("\nTukey's HSD Post-hoc Test:")
    print(tukey_results)
```

```
Treatment A Mean Growth: 9.6730
Treatment B Mean Growth: 11.1377
Treatment C Mean Growth: 15.2652
F-Statistic: 36.1214
P-Value: 0.0000
Reject the null hypothesis: There is a significant difference in mean
growth rates among the three treatments.

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
--------------------------------------------------
```

[ ]:
```
#EX.NO :10 Feature Scaling
#DATA  : 22.10.2024

#NAME : KK SHYAAM
#ROLL NO : 230701313
#DEPARTMENT : B.E COMPUTER SCIENCE AND ENGINEERING - E
```

[130]:
```
import numpy as np
import pandas as pd
import warnings
warnings.filterwarnings('ignore')
df=pd.read_csv('pre_process_datasample.csv')
```

[131]:
```
df.head()
```

[131]:

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

[132]:
```
df.Country.fillna(df.Country.mode()[0],inplace=True)
features=df.iloc[:,:-1].values
features
```

[132]:
```
array([['France', 44.0, 72000.0],
       ['Spain', 27.0, 48000.0],
       ['Germany', 30.0, 54000.0],
       ['Spain', 38.0, 61000.0],
       ['Germany', 40.0, nan],
       ['France', 35.0, 58000.0],
       ['Spain', nan, 52000.0],
       ['France', 48.0, 79000.0],
       ['Germany', 50.0, 83000.0],
       ['France', 37.0, 67000.0]], dtype=object)
```

[133]:
```
label=df.iloc[:,-1].values
```

```
```

[134]:
```
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]])
```

[134]:
```
SimpleImputer()
```

[135]:
```
Salary.fit(features[:,[2]])
```

[135]:
```
SimpleImputer()
```

[136]:
```
SimpleImputer()
```

[136]:
```
SimpleImputer()
```

[137]:
```
features[:,[1]]=age.transform(features[:,[1]])
features[:,[2]]=Salary.transform(features[:,[2]])
features
```

[137]:
```
array([['France', 44.0, 72000.0],
       ['Spain', 27.0, 48000.0],
       ['Germany', 30.0, 54000.0],
       ['Spain', 38.0, 61000.0],
       ['Germany', 40.0, 63777.77777777778],
       ['France', 35.0, 58000.0],
       ['Spain', 38.77777777777778, 52000.0],
       ['France', 48.0, 79000.0],
       ['Germany', 50.0, 83000.0],
       ['France', 37.0, 67000.0]], dtype=object)
```

[138]:
```
from sklearn.preprocessing import OneHotEncoder
oh = OneHotEncoder(sparse_output=False)
Country=oh.fit_transform(features[:,[0]])
Country
```

[138]:
```
array([[1., 0., 0.],
       [0., 0., 1.],
       [0., 1., 0.],
       [0., 0., 1.],
       [0., 1., 0.],
       [1., 0., 0.],
       [0., 0., 1.],
       [1., 0., 0.],
       [0., 1., 0.],
       [1., 0., 0.]])
```

[139]:
```
final_set=np.concatenate((Country,features[:,[1,2]]),axis=1)
final_set
```

[139]:
```
array([[1.0, 0.0, 0.0, 44.0,
        72000.0], [0.0, 0.0, 1.0, 27.0,
        48000.0],
        [0.0, 1.0, 0.0, 30.0, 54000.0],
        [0.0, 0.0, 1.0, 38.0, 61000.0],
        [0.0, 1.0, 0.0, 40.0, 63777.77777777778],
        [1.0, 0.0, 0.0, 35.0, 58000.0],
        [0.0, 0.0, 1.0, 38.77777777777778, 52000.0],
        [1.0, 0.0, 0.0, 48.0, 79000.0],
        [0.0, 1.0, 0.0, 50.0, 83000.0],
        [1.0, 0.0, 0.0, 37.0, 67000.0]], dtype=object)
```

[140]:
```
from sklearn.preprocessing import StandardScaler
sc=StandardScaler()
sc.fit(final_set)
feat_standard_scaler=sc.transform(final_set)
```

[141]:
```
feat_standard_scaler
```

[141]:
```
array([[ 1.22474487e+00, -6.54653671e-01, -6.54653671e-01,
         7.58874362e-01, 7.49473254e-01],
       [-8.16496581e-01, -6.54653671e-01, 1.52752523e+00, -
        1.71150388e+00, -1.43817841e+00],
       [-8.16496581e-01, 1.52752523e+00, -6.54653671e-01, -
        1.27555478e+00, -8.91265492e-01],
       [-8.16496581e-01, -6.54653671e-01, 1.52752523e+00, -
        1.13023841e-01, -2.53200424e-01],
       [-8.16496581e-01, 1.52752523e+00, -6.54653671e-01,
         1.77608893e-01, 6.63219199e-16],
       [ 1.22474487e+00, -6.54653671e-01, -6.54653671e-01, -
        5.48972942e-01, -5.26656882e-01],
       [-8.16496581e-01, -6.54653671e-01, 1.52752523e+00,
         0.00000000e+00, -1.07356980e+00],
       [ 1.22474487e+00, -6.54653671e-01, -6.54653671e-01,
         1.34013983e+00, 1.38753832e+00],
       [-8.16496581e-01, 1.52752523e+00, -6.54653671e-01,
       1.63077256e+00, 1.75214693e+00],
       [ 1.22474487e+00, -6.54653671e-01, -6.54653671e-01,
        -2.58340208e-01, 2.93712492e-01]])
```

[142]:
```
from sklearn.preprocessing import MinMaxScaler
mms=MinMaxScaler(feature_range=(0,1))
mms.fit(final_set)
feat_minmax_scaler=mms.transform(final_set)
feat_minmax_scaler
```

[142]:
```
array([[1.        , 0.        , 0.        , 0.73913043, 0.68571429],
       [0.        , 0.        , 1.        , 0.        , 0.        ],
```

```
       [0.       , 1.       , 0.     , 0.13043478, 0.17142857],
       [0.       , 0.       , 1.     , 0.47826087, 0.37142857],
       [0.       , 1.  , 0.  , 0.56521739, 0.45079365],
       [1.       , 0.  , 0.  , 0.34782609, 0.28571429],
       [0.       , 0.  , 1.  , 0.51207729, 0.11428571],
       [1.       , 0.  , 0.  , 0.91304348, 0.88571429],
       [0.       , 1.       , 0.       , 1.       , 1.       ],
       [1.       , 0.       , 0.       , 0.43478261, 0.54285714]])
```

[ ]:
```
#EX.NO :11 Linear Regression
#DATA  : 29.10.2024

#NAME : KK SHYAAM
#ROLL NO : 230701313
#DEPARTMENT : B.E COMPUTER SCIENCE AND ENGINEERING - E
```

[144]:
```
import numpy as np
import pandas as pd
df = pd.read_csv('Salary_data.csv')
df
```

[144]:

	YearsExperience	Salary
0	1.1	39343
1	1.3	46205
2	1.5	37731
3	2.0	43525
4	2.2	39891
5	2.9	56642
6	3.0	60150
7	3.2	54445
8	3.2	64445
9	3.7	57189
10	3.9	63218
11	4.0	55794
12	4.0	56957
13	4.1	57081
14	4.5	61111
15	4.9	67938
16	5.1	66029
17	5.3	83088
18	5.9	81363
19	6.0	93940
20	6.8	91738
21	7.1	98273
22	7.9	101302
23	8.2	113812
24	8.7	109431

```
25            9.0 105582
26            9.5 116969
27            9.6 112635 28 10.3 122391
29           10.5 121872
```

[145]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
  RangeIndex: 30 entries, 0 to
  29 Data columns (total 2
  columns):
   #   Column          Non-Null Count Dtype
  --- ------ -------------- ----0
   YearsExperience 30 non-null float64
   1   Salary          30 non-null    int64
  dtypes: float64(1), int64(1)
  memory usage: 612.0 bytes
```

[146]:
```
df.dropna(inplace=True);
df
```

[146]:

	YearsExperience	Salary
0	1.1	39343
1	1.3	46205
2	1.5	37731
3	2.0	43525
4	2.2	39891
5	2.9	56642
6	3.0	60150
7	3.2	54445
8	3.2	64445
9	3.7	57189
10	3.9	63218
11	4.0	55794
12	4.0	56957
13	4.1	57081
14	4.5	61111
15	4.9	67938
16	5.1	66029
17	5.3	83088
18	5.9	81363
19	6.0	93940
20	6.8	91738
21	7.1	98273
22	7.9	101302
23	8.2	113812
24	8.7	109431
25	9.0	105582

```
26             9.5 116969
27             9.6 112635 28 10.3 122391
29            10.5 121872
```

[147]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
  RangeIndex: 30 entries, 0 to
  29 Data columns (total 2
  columns):
   #   Column          Non-Null Count Dtype
  --- ------ -------------- ----0
   YearsExperience 30 non-null float64
   1   Salary          30 non-null    int64
  dtypes: float64(1), int64(1)
  memory usage: 612.0 bytes
```

[148]:
```
df.describe()  #descripte statical report
# find out lYER FOR BELOW META DATA
```

[148]:
```
  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
```

[149]:
```
features = df.iloc[:,[0]].values # : - > all row , 0 -> first column

#iloc index based selection loc location based sentence

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

[149]:
```
features
```

```
array([[
        1.1],
        [
        1.3],
        [ 1.5],
        [ 2. ],
        [ 2.2],
        [ 2.9],
        [ 3. ],
```

```
            [ 3.2],
            [ 3.2],
            [ 3.7],
            [ 3.9],
            [ 4. ],
            [ 4. ],
            [ 4.1],
            [ 4.5],
            [ 4.9],
            [ 5.1],
            [ 5.3],
            [ 5.9],
            [ 6. ],
            [ 6.8],
            [ 7.1],
            [ 7.9],
            [ 8.2],
            [ 8.7],
            [ 9. ],
            [ 9.5],
           [ 9.6],
           [10.3],
            [10.5]])
```

[150]:

```
label
```

[150]:
```
array([[
            39343],
            [
            46205],
            [ 37731],
            [ 43525],
            [ 39891],
            [ 56642],
            [ 60150],
            [ 54445],
            [ 64445],
            [ 57189],
            [ 63218],
            [ 55794],
            [ 56957],
            [ 57081],
            [ 61111],
            [ 67938],
            [ 66029],
```

```
       [ 83088],
       [ 81363],
       [ 93940],
       [ 91738],
       [ 98273],
       [101302],
       [113812],
       [109431],
       [105582],
       [116969],
       [112635],
       [122391],
       [121872]], dtype=int64)
```

[151]:
```
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=23)
# x independent input train 80 % test 20 %
'''
y is depenent ouput
0.2 allocate test for 20 % automatically train for
80 % '''
```

[151]:
```
'\ny is depenent ouput\n0.2 allocate test for 20 % automatically
train for 80 %\n'
```

[152]:
```
from sklearn.linear_model import LinearRegression
model = LinearRegression()
model.fit(x_train,y_train)
'''
sk - size kit
linear means using linear regression
fit means add data
'''
```

[152]:
```
'\nsk - size kit \nlinear means using linear regression \nfit means
add data \n'
```

[153]:
```
model.score(x_train,y_train)
'''
accuracy calculating
96 %
'''
```

[153]:
```
'\naccuracy calculating\n96 %\n'
```

[154]:
```
model.score(x_test,y_test)
'''
accuracy calculating
91 %
'''
```

[154]:
```
'\naccuracy calculating\n91 %\n'
```

[155]:
```
model.coef_
```

[155]:
```
array([[9281.30847068]])
```

[156]:
```
model.intercept_
```

[156]:
```
array([27166.73682891])
```

[157]:
```
import pickle
pickle.dump(model,open('SalaryPred.model','wb'))
'''
pickle momory obj to file

'''
```

[157]:
```
'\npickle momory obj to file\n\n'
```

[158]:
```
model = pickle.load(open('SalaryPred.model','rb'))
```

[159]:
```
yr_of_exp = float(input("Enter years of expreience:
")) yr_of_exp_NP = np.array([[yr_of_exp]]) salary =
model.predict(yr_of_exp_NP) print("Estimated salary
for {} years of expreience is {} . ".
 ↪format(yr_of_exp,salary))
```

```
Enter years of expreience: 24
Estimated salary for 24.0 years of expreience is [[249918.14012525]]
.
```

[160]:
```
print(f" Estimated salary for {yr_of_exp} years of expreience is
{salary} . ")
```

```
Estimated salary for 24.0 years of expreience is [[249918.14012525]] .
```

[ ]:
```
#EX.NO :12   Logistic Regression
#DATA  : 05.11.2024
```

```
#NAME : KK SHYAAM
#ROLL NO : 230701313
#DEPARTMENT : B.E COMPUTER SCIENCE AND ENGINEERING - E
```

[162]:
```
import numpy as np
import pandas as pd
import warnings
warnings.filterwarnings('ignore')
df=pd.read_csv('Social_Network_Ads.csv.csv')
df
```

[162]:

	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]

[163]:
```
df.tail(20)
```

[163]:

	User ID	Gender	Age	EstimatedSalary	Purchased
380	15683758	Male	42	64000	0
381	15670615	Male	48	33000	1
382	15715622	Female	44	139000	1
383	15707634	Male	49	28000	1
384	15806901	Female	57	33000	1
385	15775335	Male	56	60000	1
386	15724150	Female	49	39000	1
387	15627220	Male	39	71000	0
388	15672330	Male	47	34000	1
389	15668521	Female	48	35000	1
390	15807837	Male	48	33000	1
391	15592570	Male	47	23000	1
392	15748589	Female	45	45000	1

393	15635893	Male	60	42000	1
394	15757632	Female	39	59000	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
```

[164]:
```
df.head(25)
```

[164]:
```
   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
5  15728773   Male  27          58000         0
6  15598044 Female  27          84000         0
7  15694829 Female  32         150000         1
8  15600575   Male  25          33000         0
9  15727311 Female  35          65000         0
10 15570769 Female  26          80000         0
11 15606274 Female  26          52000         0
12 15746139   Male  20          86000         0
13 15704987   Male  32          18000         0
14 15628972   Male  18          82000         0
15 15697686   Male  29          80000         0
16 15733883   Male  47          25000         1
17 15617482   Male  45          26000         1
18 15704583   Male  46          28000         1
19 15621083 Female  48          29000         1
20 15649487   Male  45          22000         1
21 15736760 Female  47          49000         1
22 15714658   Male  48          41000         1
23 15599081 Female  45          22000         1
24 15705113   Male  46          23000         1
```

[165]:
```
features = df.iloc[:,[2,3]].values
label = df.iloc[:,4].values
features
```

[165]:
```
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],
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```

[166]:

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label
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 [166]: array([0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 1, 1,
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```

[167]:
```
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LogisticRegression
```

[168]:
```
# Assuming `features` and `label` are already defined

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(f"Test Score: {test_score:.4f} | Train Score: {train_score:.4f} |
 Random State: {i}")

'''


'''
```

```
Test Score: 0.9000 | Train Score: 0.8406 | Random State: 4
Test Score: 0.8625 | Train Score: 0.8500 | Random State: 5
Test Score: 0.8625 | Train Score: 0.8594 | Random State: 6
Test Score: 0.8875 | Train Score: 0.8375 | Random State: 7
Test Score: 0.8625 | Train Score: 0.8375 | Random State: 9
Test Score: 0.9000 | Train Score: 0.8406 | Random State: 10
Test Score: 0.8625 | Train Score: 0.8562 | Random State: 14
Test Score: 0.8500 | Train Score: 0.8438 | Random State: 15
Test Score: 0.8625 | Train Score: 0.8562 | Random State: 16
Test Score: 0.8750 | Train Score: 0.8344 | Random State: 18
Test Score: 0.8500 | Train Score: 0.8438 | Random State: 19
```

```
Test Score: 0.8750 | Train Score: 0.8438 | Random State: 20
Test Score: 0.8625 | Train Score: 0.8344 | Random State: 21
Test Score: 0.8750 | Train Score: 0.8406 | Random State: 22
Test Score: 0.8750 | Train Score: 0.8406 | Random State: 24
Test Score: 0.8500 | Train Score: 0.8344 | Random State: 26
Test Score: 0.8500 | Train Score: 0.8406 | Random State: 27
Test Score: 0.8625 | Train Score: 0.8344 | Random State: 30
Test Score: 0.8625 | Train Score: 0.8562 | Random State: 31
Test Score: 0.8750 | Train Score: 0.8531 | Random State: 32
Test Score: 0.8625 | Train Score: 0.8438 | Random State: 33
Test Score: 0.8750 | Train Score: 0.8313 | Random State: 35
Test Score: 0.8625 | Train Score: 0.8531 | Random State: 36
Test Score: 0.8875 | Train Score: 0.8406 | Random State: 38
Test Score: 0.8750 | Train Score: 0.8375 | Random State: 39
Test Score: 0.8875 | Train Score: 0.8375 | Random State: 42
Test Score: 0.8750 | Train Score: 0.8469 | Random State: 46
Test Score: 0.9125 | Train Score: 0.8313 | Random State: 47
Test Score: 0.8750 | Train Score: 0.8313 | Random State: 51
Test Score: 0.9000 | Train Score: 0.8438 | Random State: 54
Test Score: 0.8500 | Train Score: 0.8438 | Random State: 57
Test Score: 0.8750 | Train Score: 0.8438 | Random State: 58
Test Score: 0.9250 | Train Score: 0.8375 | Random State: 61
Test Score: 0.8875 | Train Score: 0.8344 | Random State: 65
Test Score: 0.8875 | Train Score: 0.8406 | Random State: 68 Test
Score: 0.9000 | Train Score: 0.8313 | Random State: 72
Test Score: 0.8875 | Train Score: 0.8375 | Random State: 75
Test Score: 0.9250 | Train Score: 0.8250 | Random State: 76
Test Score: 0.8625 | Train Score: 0.8406 | Random State: 77
Test Score: 0.8625 | Train Score: 0.8594 | Random State: 81
Test Score: 0.8750 | Train Score: 0.8375 | Random State: 82
Test Score: 0.8875 | Train Score: 0.8375 | Random State: 83
Test Score: 0.8625 | Train Score: 0.8531 | Random State: 84
Test Score: 0.8625 | Train Score: 0.8406 | Random State: 85
Test Score: 0.8625 | Train Score: 0.8406 | Random State: 87
Test Score: 0.8750 | Train Score: 0.8469 | Random State: 88
Test Score: 0.9125 | Train Score: 0.8375 | Random State: 90
Test Score: 0.8625 | Train Score: 0.8500 | Random State: 95
Test Score: 0.8750 | Train Score: 0.8500 | Random State: 99
Test Score: 0.8500 | Train Score: 0.8406 | Random State: 101
Test Score: 0.8500 | Train Score: 0.8406 | Random State: 102
Test Score: 0.9000 | Train Score: 0.8250 | Random State: 106
Test Score: 0.8625 | Train Score: 0.8406 | Random State: 107
Test Score: 0.8500 | Train Score: 0.8344 | Random State: 109
Test Score: 0.8500 | Train Score: 0.8406 | Random State: 111
Test Score: 0.9125 | Train Score: 0.8406 | Random State: 112
Test Score: 0.8625 | Train Score: 0.8500 | Random State: 115
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```
Test Score: 0.8625 | Train Score: 0.8406 | Random State: 116
Test Score: 0.8750 | Train Score: 0.8344 | Random State: 119
Test Score: 0.9125 | Train Score: 0.8281 | Random State: 120
Test Score: 0.8625 | Train Score: 0.8594 | Random State: 125
Test Score: 0.8500 | Train Score: 0.8469 | Random State: 128
Test Score: 0.8750 | Train Score: 0.8500 | Random State: 130
Test Score: 0.9000 | Train Score: 0.8438 | Random State: 133
Test Score: 0.9250 | Train Score: 0.8344 | Random State: 134
Test Score: 0.8625 | Train Score: 0.8500 | Random State: 135
Test Score: 0.8750 | Train Score: 0.8313 | Random State: 138
Test Score: 0.8625 | Train Score: 0.8500 | Random State: 141
Test Score: 0.8500 | Train Score: 0.8469 | Random State: 143
Test Score: 0.8500 | Train Score: 0.8469 | Random State: 146
Test Score: 0.8500 | Train Score: 0.8438 | Random State: 147
Test Score: 0.8625 | Train Score: 0.8500 | Random State: 148
Test Score: 0.8750 | Train Score: 0.8375 | Random State: 150
Test Score: 0.8875 | Train Score: 0.8313 | Random State: 151
Test Score: 0.9250 | Train Score: 0.8438 | Random State: 152
Test Score: 0.8500 | Train Score: 0.8406 | Random State: 153
Test Score: 0.9000 | Train Score: 0.8438 | Random State: 154
Test Score: 0.9000 | Train Score: 0.8406 | Random State: 155
Test Score: 0.8875 | Train Score: 0.8469 | Random State: 156
Test Score: 0.8875 | Train Score: 0.8344 | Random State: 158
Test Score: 0.8750 | Train Score: 0.8281 | Random State: 159
Test Score: 0.9000 | Train Score: 0.8313 | Random State: 161
Test Score: 0.8500 | Train Score: 0.8375 | Random State: 163
Test Score: 0.8750 | Train Score: 0.8313 | Random State: 164
Test Score: 0.8625 | Train Score: 0.8500 | Random State: 169
Test Score: 0.8750 | Train Score: 0.8406 | Random State: 171
Test Score: 0.8500 | Train Score: 0.8406 | Random State: 172
Test Score: 0.9000 | Train Score: 0.8250 | Random State: 180
Test Score: 0.8500 | Train Score: 0.8344 | Random State: 184
Test Score: 0.9250 | Train Score: 0.8219 | Random State: 186
Test Score: 0.9000 | Train Score: 0.8313 | Random State: 193
Test Score: 0.8625 | Train Score: 0.8500 | Random State: 195
Test Score: 0.8625 | Train Score: 0.8406 | Random State: 196
Test Score: 0.8625 | Train Score: 0.8375 | Random State: 197
Test Score: 0.8750 | Train Score: 0.8406 | Random State: 198
Test Score: 0.8875 | Train Score: 0.8375 | Random State: 199
Test Score: 0.8875 | Train Score: 0.8438 | Random State: 200
Test Score: 0.8625 | Train Score: 0.8375 | Random State: 202
Test Score: 0.8625 | Train Score: 0.8406 | Random State: 203
Test Score: 0.8875 | Train Score: 0.8313 | Random State: 206
Test Score: 0.8625 | Train Score: 0.8344 | Random State: 211
Test Score: 0.8500 | Train Score: 0.8438 | Random State: 212
Test Score: 0.8625 | Train Score: 0.8344 | Random State: 214
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Test Score: 0.8750 | Train Score: 0.8313 | Random State: 217
Test Score: 0.9625 | Train Score: 0.8187 | Random State: 220
Test Score: 0.8750 | Train Score: 0.8438 | Random State: 221
Test Score: 0.8500 | Train Score: 0.8406 | Random State: 222
Test Score: 0.9000 | Train Score: 0.8438 | Random State: 223
Test Score: 0.8625 | Train Score: 0.8531 | Random State: 227
Test Score: 0.8625 | Train Score: 0.8344 | Random State: 228
Test Score: 0.9000 | Train Score: 0.8406 | Random State: 229
Test Score: 0.8500 | Train Score: 0.8438 | Random State: 232
Test Score: 0.8750 | Train Score: 0.8469 | Random State: 233
Test Score: 0.9125 | Train Score: 0.8406 | Random State: 234
Test Score: 0.8625 | Train Score: 0.8406 | Random State: 235
Test Score: 0.8500 | Train Score: 0.8469 | Random State: 236
Test Score: 0.8750 | Train Score: 0.8469 | Random State: 239
Test Score: 0.8500 | Train Score: 0.8438 | Random State: 241
Test Score: 0.8875 | Train Score: 0.8500 | Random State: 242
Test Score: 0.8875 | Train Score: 0.8250 | Random State: 243
Test Score: 0.8750 | Train Score: 0.8469 | Random State: 244
Test Score: 0.8750 | Train Score: 0.8406 | Random State: 245
Test Score: 0.8750 | Train Score: 0.8469 | Random State: 246
Test Score: 0.8625 | Train Score: 0.8594 | Random State: 247
Test Score: 0.8875 | Train Score: 0.8438 | Random State: 248
Test Score: 0.8625 | Train Score: 0.8500 | Random State: 250
Test Score: 0.8750 | Train Score: 0.8313 | Random State: 251
Test Score: 0.8875 | Train Score: 0.8438 | Random State: 252
Test Score: 0.8625 | Train Score: 0.8469 | Random State: 255
Test Score: 0.9000 | Train Score: 0.8406 | Random State: 257
Test Score: 0.8625 | Train Score: 0.8562 | Random State: 260
Test Score: 0.8625 | Train Score: 0.8406 | Random State: 266
Test Score: 0.8625 | Train Score: 0.8375 | Random State: 268
Test Score: 0.8750 | Train Score: 0.8406 | Random State: 275
Test Score: 0.8625 | Train Score: 0.8500 | Random State: 276
Test Score: 0.9250 | Train Score: 0.8375 | Random State: 277
Test Score: 0.8750 | Train Score: 0.8469 | Random State: 282
Test Score: 0.8500 | Train Score: 0.8469 | Random State: 283
Test Score: 0.8500 | Train Score: 0.8438 | Random State: 285
Test Score: 0.9125 | Train Score: 0.8344 | Random State: 286
Test Score: 0.8500 | Train Score: 0.8406 | Random State: 290
Test Score: 0.8500 | Train Score: 0.8406 | Random State: 291
Test Score: 0.8500 | Train Score: 0.8469 | Random State: 292
Test Score: 0.8625 | Train Score: 0.8375 | Random State: 294
Test Score: 0.8875 | Train Score: 0.8281 | Random State: 297
Test Score: 0.8625 | Train Score: 0.8344 | Random State: 300
Test Score: 0.8625 | Train Score: 0.8500 | Random State: 301
Test Score: 0.8875 | Train Score: 0.8500 | Random State: 302
Test Score: 0.8750 | Train Score: 0.8469 | Random State: 303
```

```
Test Score: 0.8625 | Train Score: 0.8344 | Random State: 305
Test Score: 0.9125 | Train Score: 0.8375 | Random State: 306
Test Score: 0.8750 | Train Score: 0.8469 | Random State: 308
Test Score: 0.9000 | Train Score: 0.8438 | Random State: 311
Test Score: 0.8625 | Train Score: 0.8344 | Random State: 313
Test Score: 0.9125 | Train Score: 0.8344 | Random State: 314
Test Score: 0.8750 | Train Score: 0.8375 | Random State: 315
Test Score: 0.9000 | Train Score: 0.8469 | Random State: 317
Test Score: 0.9125 | Train Score: 0.8219 | Random State: 319
Test Score: 0.8625 | Train Score: 0.8500 | Random State: 321
Test Score: 0.9125 | Train Score: 0.8281 | Random State: 322
Test Score: 0.8500 | Train Score: 0.8469 | Random State: 328
Test Score: 0.8500 | Train Score: 0.8375 | Random State: 332
Test Score: 0.8875 | Train Score: 0.8531 | Random State: 336
Test Score: 0.8500 | Train Score: 0.8375 | Random State: 337
Test Score: 0.8750 | Train Score: 0.8406 | Random State: 343
Test Score: 0.8625 | Train Score: 0.8438 | Random State: 346
Test Score: 0.8875 | Train Score: 0.8313 | Random State: 351
Test Score: 0.8625 | Train Score: 0.8500 | Random State: 352
Test Score: 0.9500 | Train Score: 0.8187 | Random State: 354
Test Score: 0.8625 | Train Score: 0.8500 | Random State: 356
Test Score: 0.9125 | Train Score: 0.8406 | Random State: 357
Test Score: 0.8625 | Train Score: 0.8375 | Random State: 358
Test Score: 0.8500 | Train Score: 0.8406 | Random State: 362
Test Score: 0.9000 | Train Score: 0.8438 | Random State: 363
Test Score: 0.8625 | Train Score: 0.8531 | Random State: 364
Test Score: 0.9375 | Train Score: 0.8219 | Random State: 366
Test Score: 0.9125 | Train Score: 0.8406 | Random State: 369
Test Score: 0.8625 | Train Score: 0.8531 | Random State: 371
Test Score: 0.9250 | Train Score: 0.8344 | Random State: 376
Test Score: 0.9125 | Train Score: 0.8281 | Random State: 377
Test Score: 0.8875 | Train Score: 0.8500 | Random State: 378
Test Score: 0.8875 | Train Score: 0.8500 | Random State: 379
Test Score: 0.8625 | Train Score: 0.8406 | Random State: 382
Test Score: 0.8625 | Train Score: 0.8594 | Random State: 386
Test Score: 0.8500 | Train Score: 0.8375 | Random State: 387
Test Score: 0.8750 | Train Score: 0.8281 | Random State: 388
Test Score: 0.8500 | Train Score: 0.8438 | Random State: 394
Test Score: 0.8625 | Train Score: 0.8375 | Random State: 395
Test Score: 0.9000 | Train Score: 0.8438 | Random State: 397
Test Score: 0.8625 | Train Score: 0.8438 | Random State: 400
```

[168]: '\n\n\n'

[169]:
```
x_train,x_test,y_train,y_test=train_test_split(features,label,test_size=0.2,random_state=209)
finalModel=LogisticRegression()
finalModel.fit(x_train,y_train)
```

[169]: LogisticRegression()

[170]:
```
print(finalModel.score(x_train,y_train))
print(finalModel.score(x_train,y_train))
```

```
0.85
0.85
```

[171]:
```
from sklearn.metrics import classification_report
print(classification_report(label,finalModel.predict(features)))
```

```
              precision    recall  f1-score   support

           0       0.86      0.91      0.89       257
           1       0.83      0.73      0.77       143

    accuracy                           0.85       400
   macro avg       0.84      0.82      0.83       400
weighted avg       0.85      0.85      0.85       400
```