Lab experiments

Roll no: 230701038
Name: Arvind Ravi
Class: CSE-A III
Subject: Fundamentals of data science (CS2334)

Experiment: 01

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

data=pd.read_csv('/content/Iris_Dataset.csv')
data
```

```
        Id SepalLengthCm SepalWidthCm PetalLengthCm PetalWidthCm variety
     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 Iris-virginica
   146 147 6.3 2.5 5.0 1.9 Iris-virginica
   147 148 6.5 3.0 5.2 2.0 Iris-virginica
   148 149 6.2 3.4 5.4 2.3 Iris-virginica
   149 150 5.9 3.0 5.1 1.8 Iris-virginica
   150 rows × 6 columns
```

```
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-null float64
      2   SepalWidthCm 150 non-null float64
      3   PetalLengthCm 150 non-null float64
    4   PetalWidthCm 150 non-null float64
    5   variety 150 non-null object   dtypes:
float64(4), int64(1), object(1)  memory usage:
7.2+ KB  data.describe()
```

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

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

count

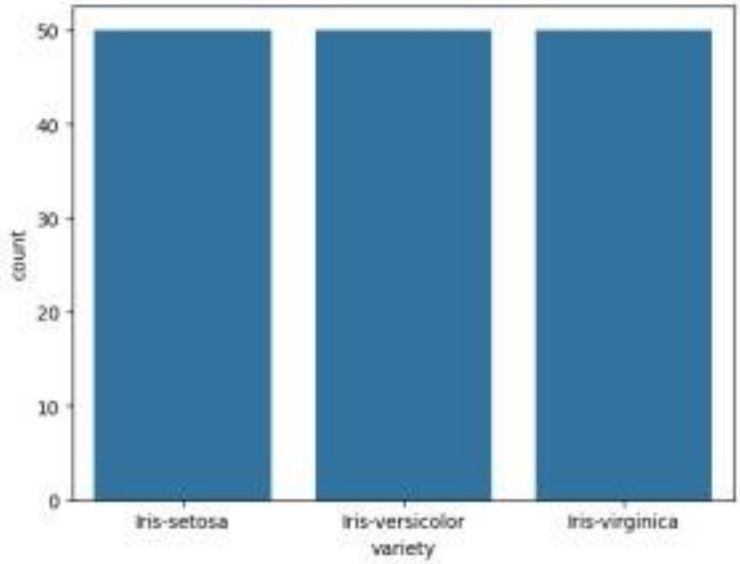
variety

Iris-setosa 50

Iris-versicolor 50

Iris-virginica 50

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



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

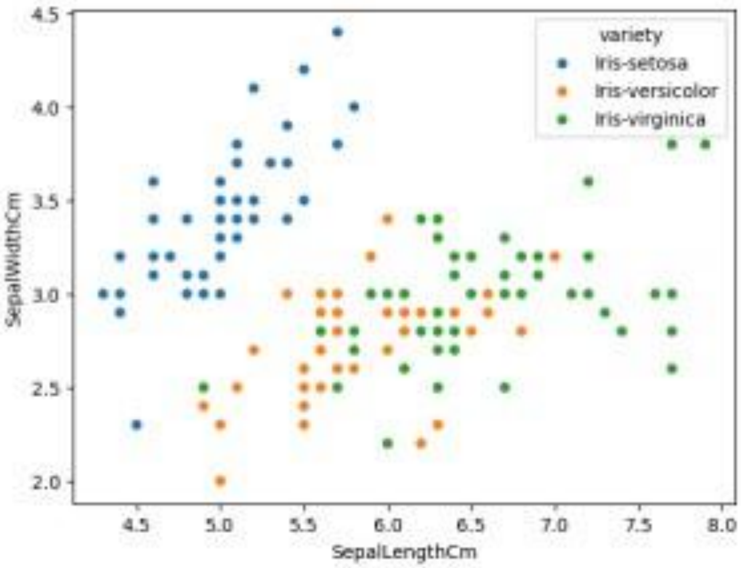
```
FinalDataset.head()
```

Iris-setosa Iris-versicolor Iris-virginica Id

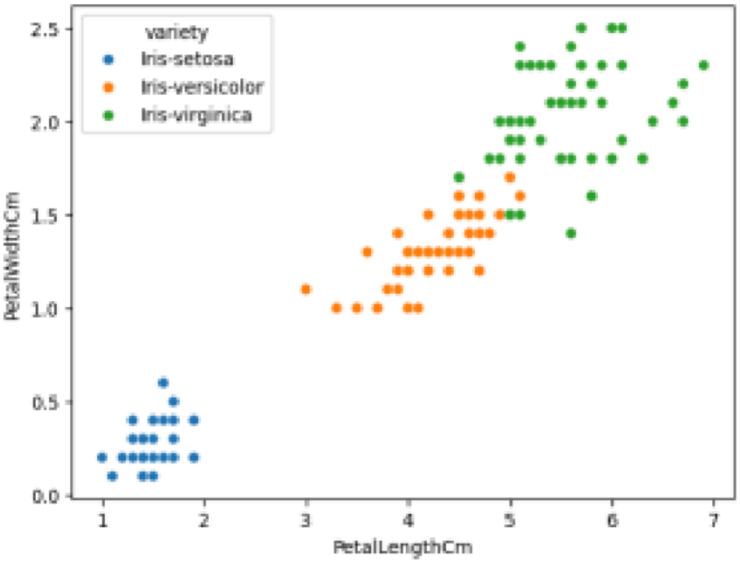
SepalLengthCm SepalWidthCm PetalLengthCm 0 True False
False 1 5.1 3.5 1.4 **1** True False False 2 4.9 3.0 1.4 **2** True False
False 3 4.7 3.2 1.3 **3** True False False 4 4.6 3.1 1.5 **4**
True False False 5 5 0 3 6 1 4

```
sns.scatterplot(x='SepalLengthCm',y='SepalWidthCm',hue='variety',data=data,)
```

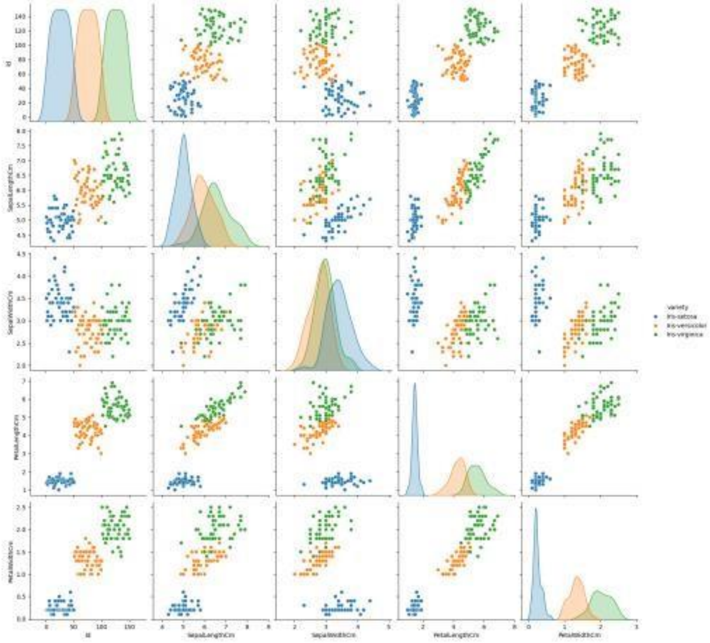
```
<Axes: xlabel='SepalLengthCm', ylabel='SepalWidthCm'>
```



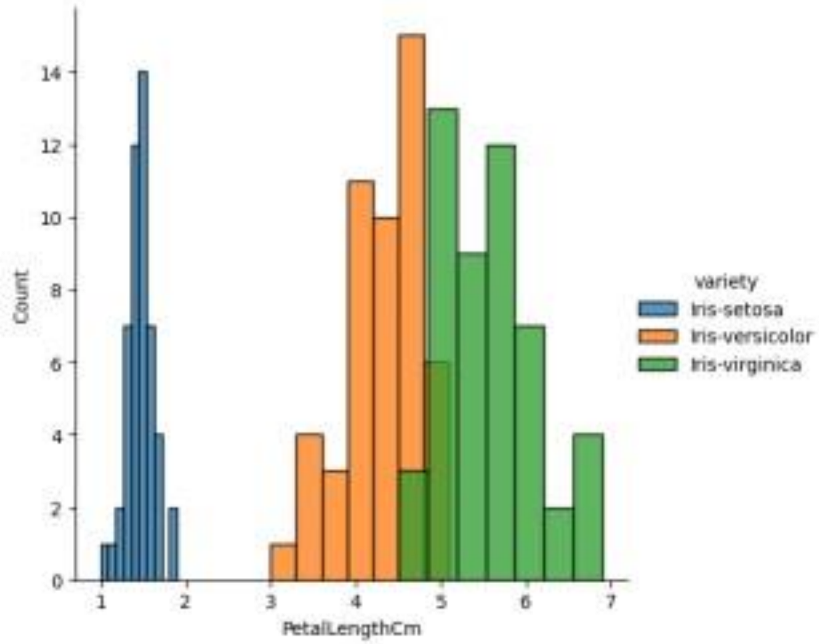
```
sns.scatterplot(x='PetalLengthCm',y='PetalWidthCm',hue='variety',data=data,)
```



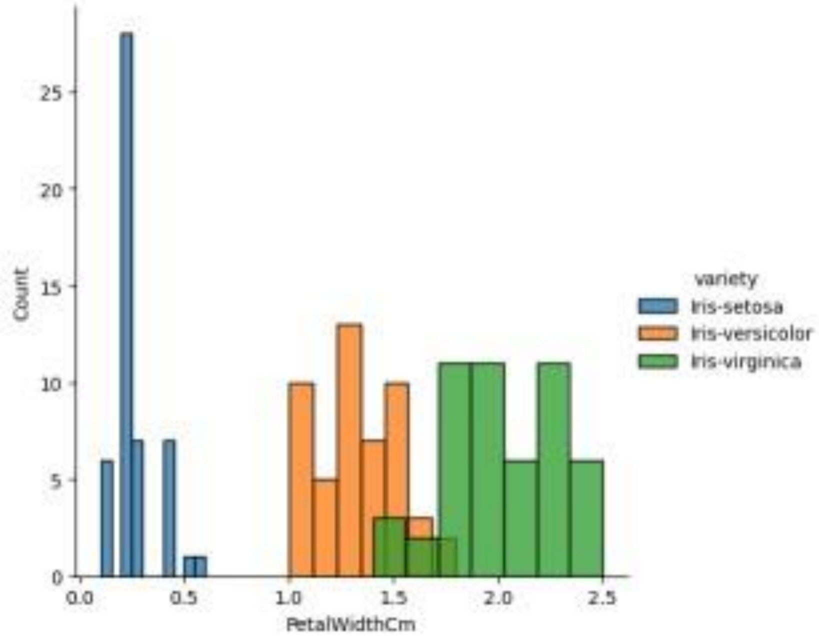
```
sns.pairplot(data,hue='variety',height=3);
```



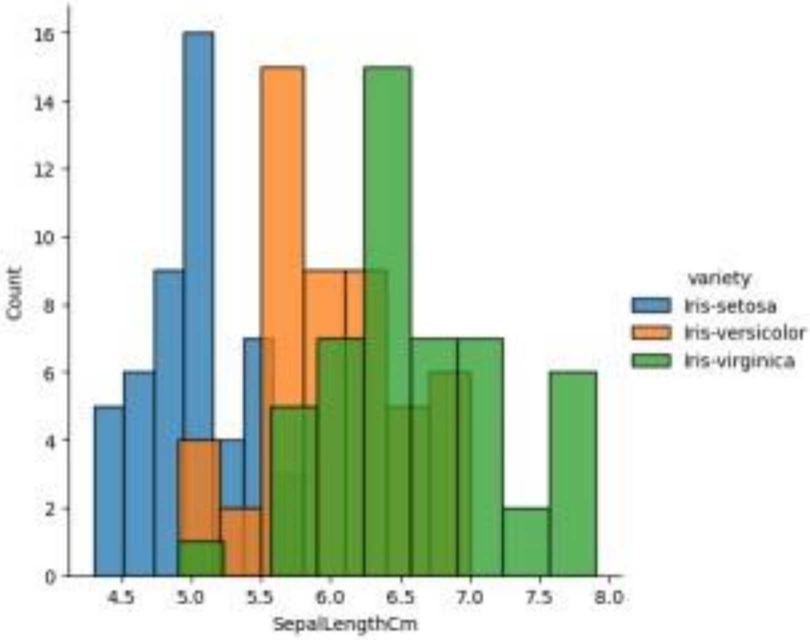
```
    plt.show()
sns.FacetGrid(data,hue='variety',height=5).map(
sns.histplot,'PetalLengthCm').add_legend();
plt.show();
```



```
sns.FacetGrid(data,hue='variety',height=5).map(
sns.histplot,'PetalWidthCm').add_legend();
plt.show();
```



```
sns.FacetGrid(data,hue='variety',height=5).map(
sns.histplot,'SepalLengthCm').add_legend();
plt.show();
```



```
sns.FacetGrid(data,hue='variety',height=5).map(sns.histplot,'SepalWidthCm').a
dd_legend();
plt.show();
```

Lab experiments
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Class: CSE-A III
Subject: Fundamentals of data science (CS2334)
Experiment: 02

```
import numpy as np

array=np.random.randint(1,100,9)  array  array([83, 25, 19,

47, 62, 15, 96, 39, 51])

np.sqrt(array)

array([9.11043358, 5. , 4.35889894, 6.8556546 , 7.87400787,

3.87298335, 9.79795897, 6.244998 , 7.14142843])

array.ndim

   1      new_array=array.re

shape(3,3)  new_array

   array([[83, 25, 19],
   [47, 62, 15],
    [96, 39, 51]])

   new_array.ndim

   2      new_array.ravel()

   array([83, 25, 19, 47, 62, 15, 96, 39, 51])

newm=new_array.reshape(3,3)  newm

   array([[83, 25, 19],
   [47, 62, 15],
    [96, 39, 51]])

newm[2,1:3]  array([39,

51])  newm[1:2,1:3]

   array([[62, 15]])

new_array[0:3,0:0]  array([], shape=(3,

0), dtype=int64)  new_array[0:2,0:1]
```

```
   array([[83],[47]])
```

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

```
   array([[83],[47],
   [96]])
   new_array[1:3]
   array([[47, 62, 15],
    [96, 39, 51]])
```

Lab experiments
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Experiment: 03

```
import numpy as np
```

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

```
df=pd.DataFrame(list)  df
```

```
     0 1 2
   0 1 Smith 50000
   1 2 Jones 60000
```

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

```
     Empd Name Salary
   0 1 Smith 50000
   1 2 Jones 60000
```

```
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: 176.0+ bytes
df=pd.read_csv("/content/50_Startups.csv")
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  df.head()
```

```
  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
```

```
df.tail()
```

```
   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
```

```
import numpy as np  import
pandas as pd
df=pd.read_csv("/content/employee.csv")

df.head()
```

```
  emp id name salary
```

```
0 1 SREE VARSSINI K S 5000
1 2 SREEMATHI B 6000
2 3 SREYA G 7000
3 4 SREYASKARI MULLAPUDI 5000
4 5 SRI AKASH U G 8000
```

```
df.tail()
```

```
  emp id name salary
2 3 SREYA G 7000
3 4 SREYASKARI MULLAPUDI 5000
4 5 SRI AKASH U G 8000
5 6 SRI HARSHAVARDHANAN R 3000
6 7 SRI HARSHAVARDHANAN R 6000
```

```
df.info()
```

```
  <class 'pandas.core.frame.DataFrame'>
  RangeIndex: 7 entries, 0 to 6   Data
  columns (total 3 columns):
   # Column Non-Null Count Dtype
  --- ------ -------------- -----
    0    emp id 7 non-null int64
    1    name 7 non-null object   2
salary 7 non-null int64   dtypes:
int64(2), object(1)  memory usage:
296.0+ bytes  df.salary
```

```
  salary
0 5000
1 6000
2 7000
3 5000
4 8000
5 3000
6 6000
```

```
type(df.salary)
```

```
pandas.core.series.Series
def __init__(data=None, index=None, dtype: Dtype | None=None,
name=None, copy: bool | None=None,  fastpath: bool=False) -> None
```

```
    One-dimensional ndarray with axis labels (including time series).

    Labels need not be unique but must be a hashable type. The object
    supports both integer- and label-based indexing and provides a host of
    methods for performing operations involving the index.
df.salary.mean()

  5714.285714285715  df.salary.median()

  6000.0  df.salary.mode()

     salary
   0 5000
   1 6000


df.salary.var()

  2571428.5714285714  df.salary.std()

  1603.5674514745463  df.describe()

        emp id salary
   count 7.000000 7.000000
   mean 4.000000 5714.285714
   std 2.160247 1603.567451  min
   1.000000 3000.000000
    25% 2.500000 5000.000000
    50% 4.000000 6000.000000
    75% 5.500000 6500.000000  max
    7 000000 8000 000000

df.describe(include='all')

         emp id name salary
    count 7.000000 7 7.000000
   unique NaN 6 NaN  top NaN SRI
     HARSHAVARDHANAN R NaN
     freq NaN 2 NaN
    mean 4.000000 NaN 5714.285714
     std 2.160247 NaN 1603.567451  min
     1.000000 NaN 3000.000000  25%
     2.500000 NaN 5000.000000
```

```
50% 4.000000 NaN 6000.000000
75% 5.500000 NaN 6500.000000
max 7 000000 NaN 8000 000000
```

```
empCol=df.columns  empCol

   Index(['emp id', 'name ', 'salary'], dtype='object')

emparray=df.values  emparray  array([[1, 'SREE VARSSINI

K S', 5000],

    [2, 'SREEMATHI B', 6000],
    [3, 'SREYA G', 7000],
    [4, 'SREYASKARI MULLAPUDI', 5000],
    [5, 'SRI AKASH U G', 8000],
    [6, 'SRI HARSHAVARDHANAN R', 3000],
    [7, 'SRI HARSHAVARDHANAN R', 6000]], dtype=object)

employee_DF=pd.DataFrame(emparray,columns=empCol)  employee_DF
```

```
  emp id name salary
0 1 SREE VARSSINI K S 5000
1 2 SREEMATHI B 6000
2 3 SREYA G 7000
3 4 SREYASKARI MULLAPUDI 5000
4 5 SRI AKASH U G 8000
5 6 SRI HARSHAVARDHANAN R 3000
6 7 SRI HARSHAVARDHANAN R 6000
```

Lab experiments
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Subject: Fundamentals of data science (CS2334) Experiment: 04

```
#sample calculation for low range(lr) , upper range (ur),percentile  import
numpy as np
array=np.random.randint(1,100,16) # randomly generate 16 numbers between 1 to
```

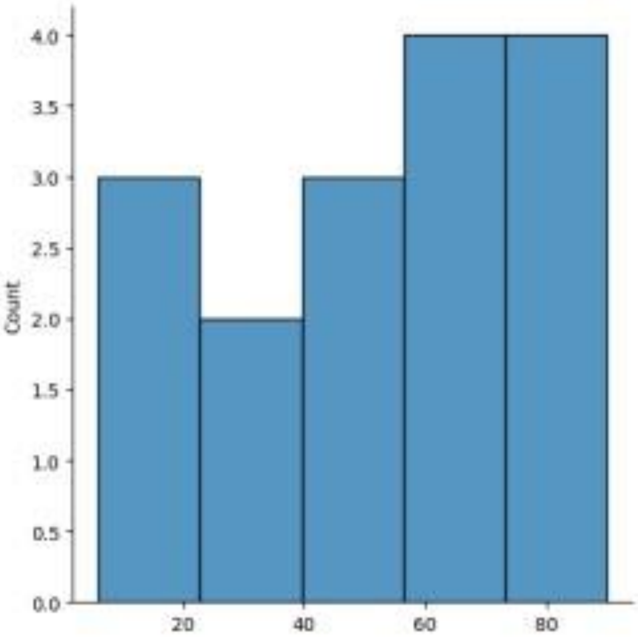
```
100  array  array([27, 50, 44, 6, 58, 61, 23, 86, 67, 20, 75, 7, 79, 61,

90, 54])  array.mean()

   50.5  np.percentile(array,25)

   26.0  np.percentile(array,50)

   56.0  np.percentile(array,75)

   69.0  np.percentile(array,100)

   90.0
```

```
#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
```

```
   (-38.5, 133.5)
```

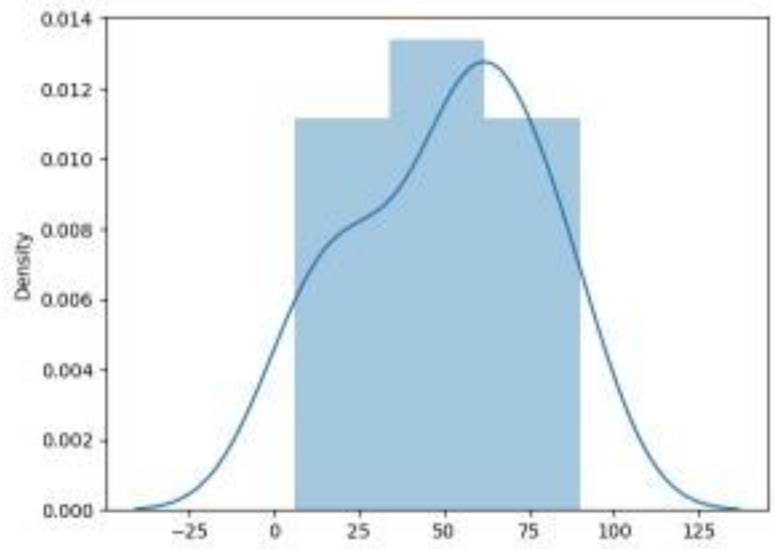
```
import seaborn as sns  %matplotlib
inline  sns.displot(array)
```

```
   <seaborn.axisgrid.FacetGrid at
   0x78f3291c2710>
```



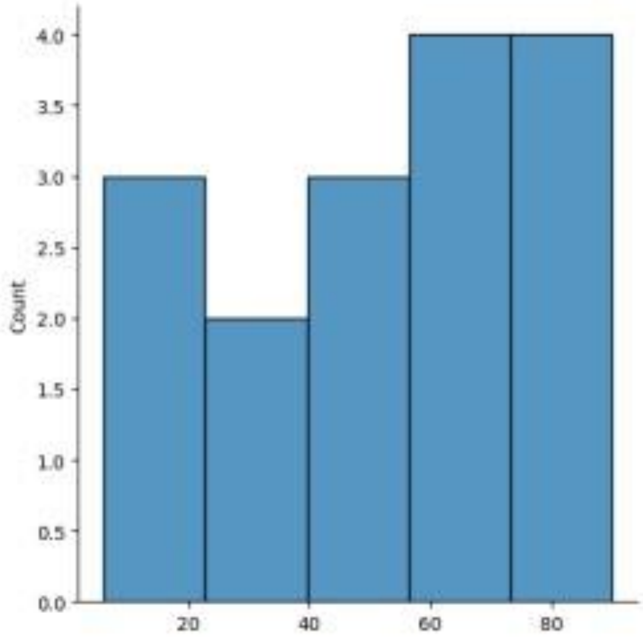
```
sns.distplot(array)
```

```
   sns.distplot(array)
   <Axes: ylabel='Density'>
```



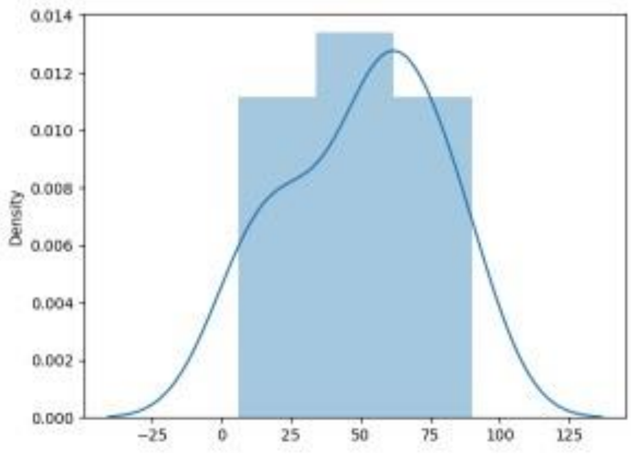
```
new_array=array[(array>lr) & (array<ur)]  new_array  array([27, 50, 44,
6, 58, 61, 23, 86, 67, 20, 75, 7, 79, 61, 90, 54])
sns.displot(new_array)
```

```
   <seaborn.axisgrid.FacetGrid at
   0x78f2e09bb580>
```



```
lr1,ur1=outDetection(new_array)
lr1,ur1  (-38.5, 133.5)
   final_array=new_array[(new_array>lr1) & (new_array<ur1)]
```

```
final_array  array([27, 50, 44, 6, 58, 61, 23, 86, 67, 20, 75, 7, 79,
61, 90, 54])  sns.distplot(final_array)
```



Lab experiments
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Subject: Fundamentals of data science (CS2334)
Experiment: 05

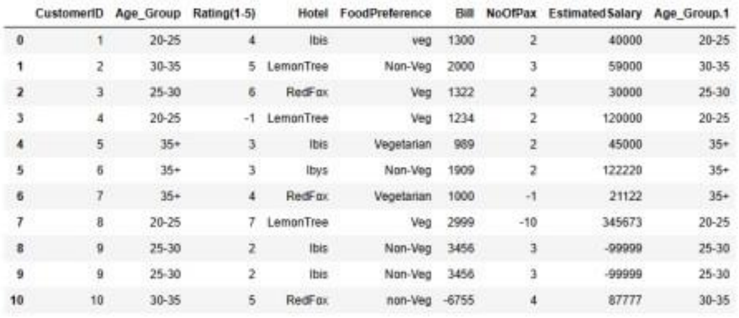
import numpy as np import pandas

as pd

df=pd.read_csv("Hotel_Dataset.csv"

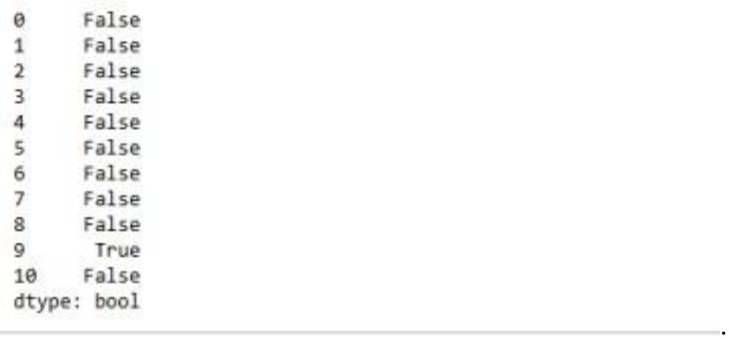
)

df



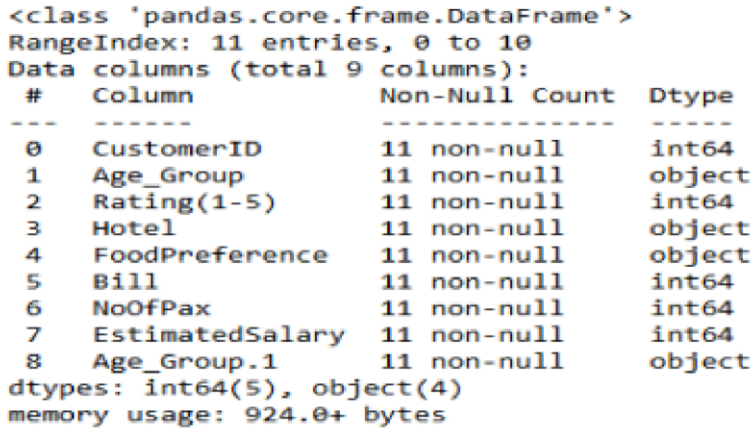
	CustomerID	Age_Group	Rating(1-5)	Hotel	FoodPreference	Bill	NoOfPax	EstimatedSalary	Age_Group.1
0	1	20-25	4	Ibis	veg	1300	2	40000	20-25
1	2	30-35	5	LemonTree	Non-Veg	2000	3	59000	30-35
2	3	25-30	6	RedFox	Veg	1322	2	30000	25-30
3	4	20-25	-1	LemonTree	Veg	1234	2	120000	20-25
4	5	35+	3	Ibis	Vegetarian	989	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
9	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

df.duplicated()



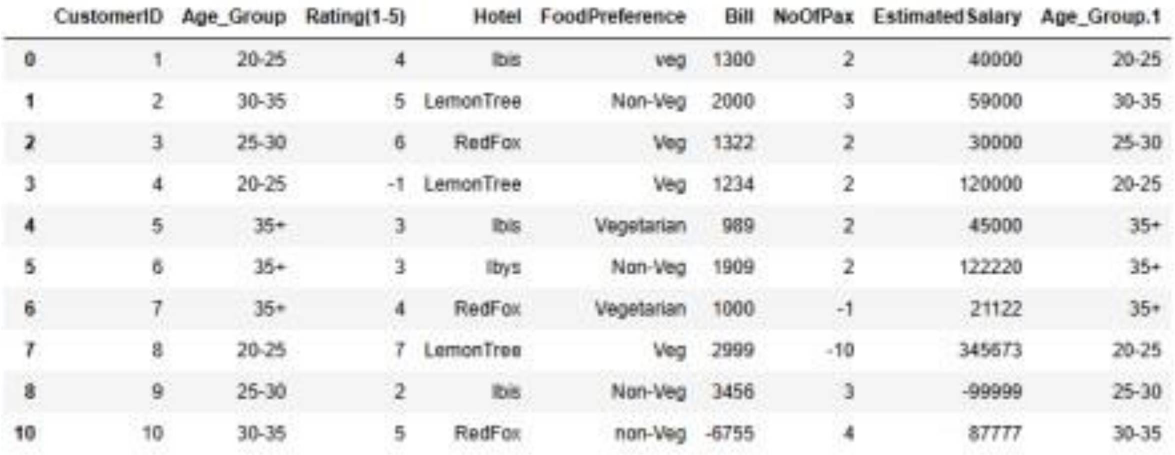
```
0     False
1     False
2     False
3     False
4     False
5     False
6     False
7     False
8     False
9      True
10    False
dtype: bool
```

df.info()



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

df.drop_duplicates(inplace=True)
df len(df) 10



	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

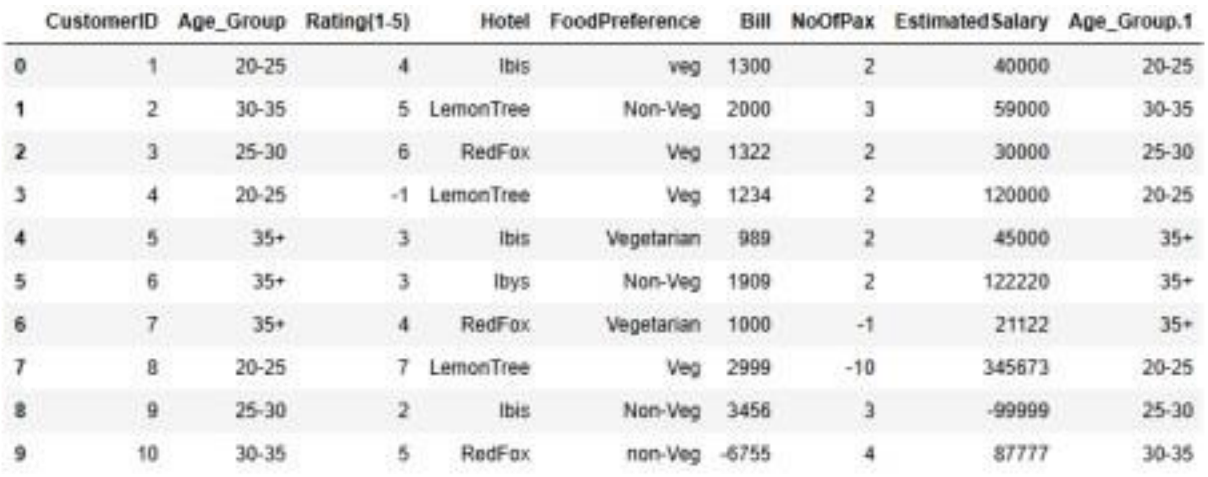
index=np.array(list(range(0,len(df))))

) df.set_index(index,inplace=True)

```
index
```

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

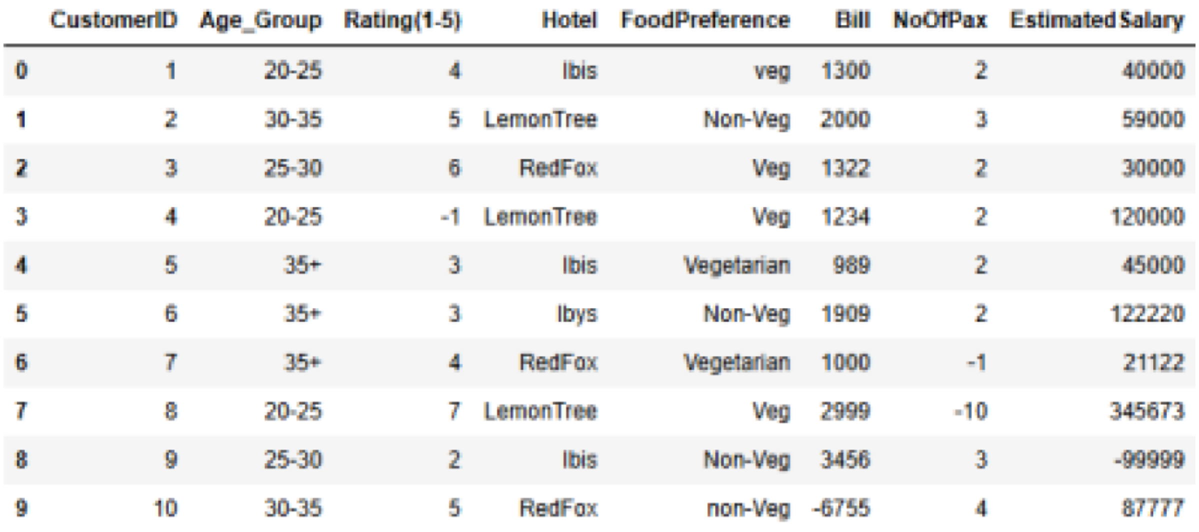
```
df
```



	CustomerID	Age_Group	Rating(1-5)	Hotel	FoodPreference	Bill	NoOfPax	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
9	10	30-35	5	RedFox	non-Veg	-6755	4	87777	30-35

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

```
df
```



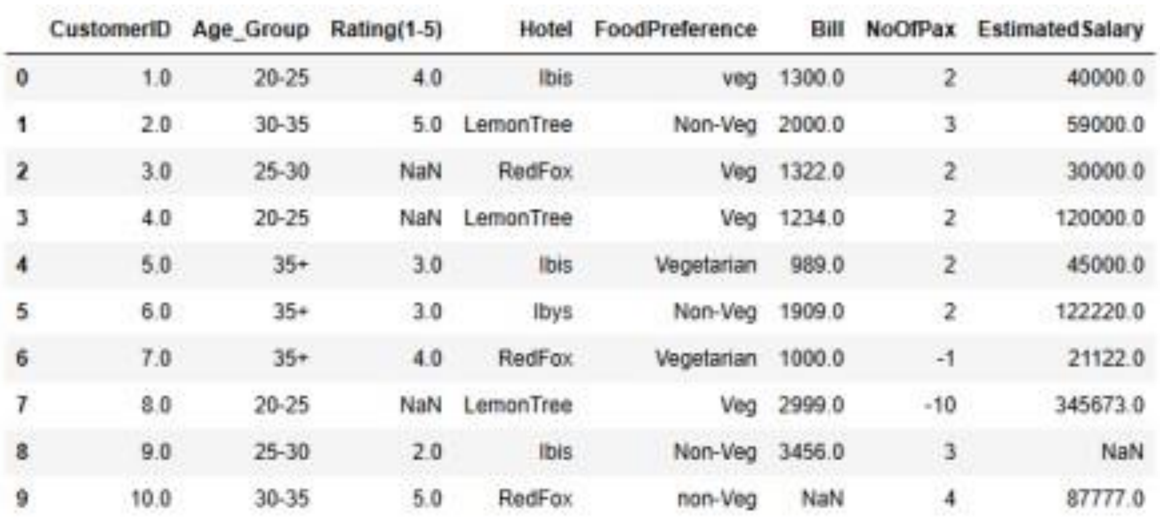
	CustomerID	Age_Group	Rating(1-5)	Hotel	FoodPreference	Bill	NoOfPax	EstimatedSalary
0	1	20-25	4	Ibis	veg	1300	2	40000
1	2	30-35	5	LemonTree	Non-Veg	2000	3	59000
2	3	25-30	6	RedFox	Veg	1322	2	30000
3	4	20-25	-1	LemonTree	Veg	1234	2	120000
4	5	35+	3	Ibis	Vegetarian	989	2	45000
5	6	35+	3	Ibys	Non-Veg	1909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

```
df.CustomerID.loc[df.CustomerID<0]=np.nan
```

```
df.Bill.loc[df.Bill<0]=np.nan
```

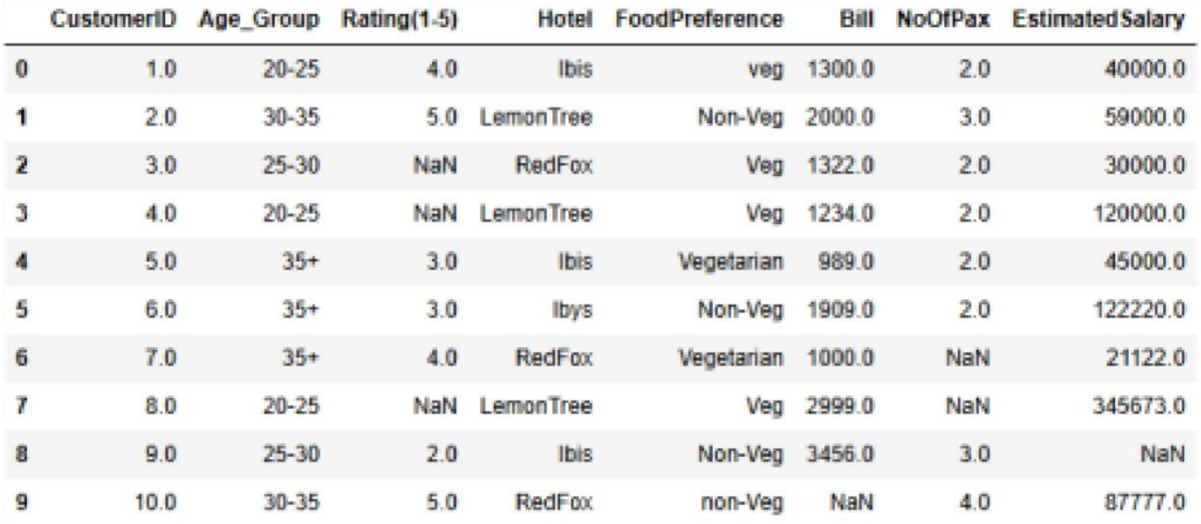
```
df.EstimatedSalary.loc[df.EstimatedSalary<0]=np.nan
```

```
df
```



	CustomerID	Age_Group	Rating(1-5)	Hotel	FoodPreference	Bill	NoOfPax	EstimatedSalary
0	1.0	20-25	4.0	Ibis	veg	1300.0	2	40000.0
1	2.0	30-35	5.0	LemonTree	Non-Veg	2000.0	3	59000.0
2	3.0	25-30	NaN	RedFox	Veg	1322.0	2	30000.0
3	4.0	20-25	NaN	LemonTree	Veg	1234.0	2	120000.0
4	5.0	35+	3.0	Ibis	Vegetarian	989.0	2	45000.0
5	6.0	35+	3.0	Ibys	Non-Veg	1909.0	2	122220.0
6	7.0	35+	4.0	RedFox	Vegetarian	1000.0	-1	21122.0
7	8.0	20-25	NaN	LemonTree	Veg	2999.0	-10	345673.0
8	9.0	25-30	2.0	Ibis	Non-Veg	3456.0	3	NaN
9	10.0	30-35	5.0	RedFox	non-Veg	NaN	4	87777.0

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



	CustomerID	Age_Group	Rating(1-5)	Hotel	FoodPreference	Bill	NoOfPax	EstimatedSalary
0	1.0	20-25	4.0	Ibis	veg	1300.0	2.0	40000.0
1	2.0	30-35	5.0	LemonTree	Non-Veg	2000.0	3.0	59000.0
2	3.0	25-30	NaN	RedFox	Veg	1322.0	2.0	30000.0
3	4.0	20-25	NaN	LemonTree	Veg	1234.0	2.0	120000.0
4	5.0	35+	3.0	Ibis	Vegetarian	989.0	2.0	45000.0
5	6.0	35+	3.0	Ibys	Non-Veg	1909.0	2.0	122220.0
6	7.0	35+	4.0	RedFox	Vegetarian	1000.0	NaN	21122.0
7	8.0	20-25	NaN	LemonTree	Veg	2999.0	NaN	345673.0
8	9.0	25-30	2.0	Ibis	Non-Veg	3456.0	3.0	NaN
9	10.0	30-35	5.0	RedFox	non-Veg	NaN	4.0	87777.0

```
df.Age_Group.unique()
array(['20-25', '30-35', '25-30', '35+'], dtype=object)
```

```
df.Hotel.unique()
```

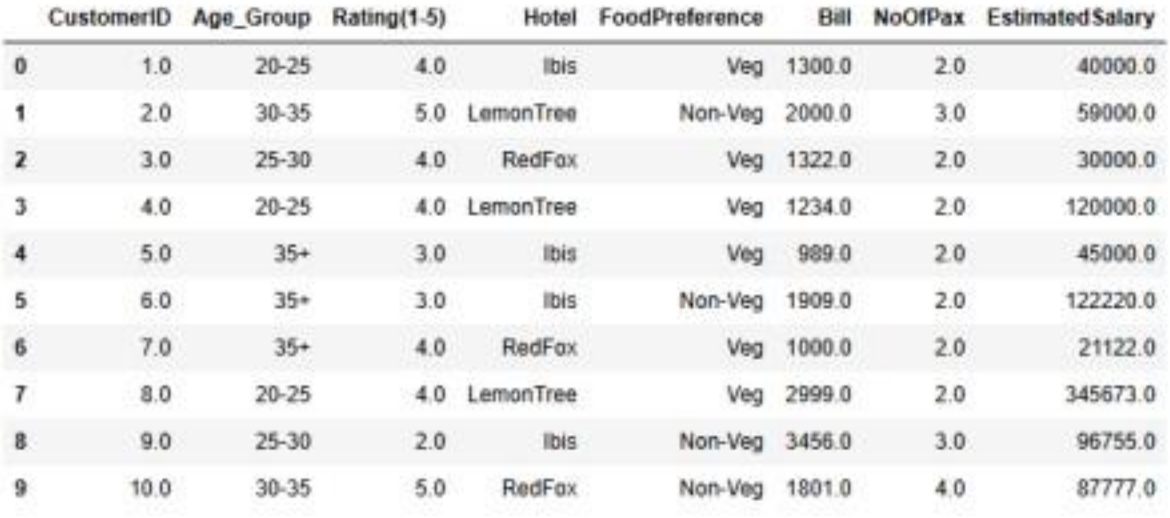
```
array(['Ibis', 'LemonTree', 'RedFox', 'Ibys'], dtype=object)
```

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

```
<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>
```

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

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

df.EstimatedSalary.fillna(round(df.EstimatedSalary.mean()),inplace=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
```



	CustomerID	Age_Group	Rating(1-5)	Hotel	FoodPreference	Bill	NoOfPax	EstimatedSalary
0	1.0	20-25	4.0	Ibis	Veg	1300.0	2.0	40000.0
1	2.0	30-35	5.0	LemonTree	Non-Veg	2000.0	3.0	59000.0
2	3.0	25-30	4.0	RedFox	Veg	1322.0	2.0	30000.0
3	4.0	20-25	4.0	LemonTree	Veg	1234.0	2.0	120000.0
4	5.0	35+	3.0	Ibis	Veg	989.0	2.0	45000.0
5	6.0	35+	3.0	Ibis	Non-Veg	1909.0	2.0	122220.0
6	7.0	35+	4.0	RedFox	Veg	1000.0	2.0	21122.0
7	8.0	20-25	4.0	LemonTree	Veg	2999.0	2.0	345673.0
8	9.0	25-30	2.0	Ibis	Non-Veg	3456.0	3.0	96755.0
9	10.0	30-35	5.0	RedFox	Non-Veg	1801.0	4.0	87777.0

Lab experiments
Roll no: 230701038
Name: Arvind Ravi
Class: CSE-A III
Subject: Fundamentals of data science (CS2334)
Experiment: 06

```
import numpy as np  import
pandas as pd
df=pd.read_csv('/content/pre-process_datasample.csv')
```

```
df
```

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

Next steps: `df.head()`

```
Country Age Salary Purchased 0
France 44.0 72000.0 No 1 Spain 27.0
48000.0 Yes 2 Germany 30.0 54000.0
No 3 Spain 38.0 61000.0 No 4
Germany 40 0 NaN Yes
```

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

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

```
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]])
```

```
    ▾ SimpleImputer
   SimpleImputer()
```

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

```
    ▾ SimpleImputer  SimpleImputer()
```

```
SimpleImputer()
```

```
    ▾ SimpleImputer SimpleImputer()
```

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

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

```
features
```

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

```
from sklearn.preprocessing import OneHotEncoder
```

```
oh = OneHotEncoder(sparse_output=False)
```

```
Country=oh.fit_transform(features[:,[0]])
```

```
Country
```

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

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

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

```
final_set
```

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

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

```
feat_standard_scaler
```

```
    array([[ 1.00000000e+00, -5.00000000e-01, -6.54653671e-01,
     7.58874362e-01, 7.49473254e-01],
     [-1.00000000e+00, -5.00000000e-01, 1.52752523e+00,
    -1.71150388e+00, -1.43817841e+00],
     [-1.00000000e+00, 2.00000000e+00, -6.54653671e-01,
    -1.27555478e+00, -8.91265492e-01],
     [-1.00000000e+00, -5.00000000e-01, 1.52752523e+00,
     -1.13023841e-01, -2.53200424e-01],
     [-1.00000000e+00, 2.00000000e+00, -6.54653671e-01,
     1.77608893e-01, 6.63219199e-16],
     [ 1.00000000e+00, -5.00000000e-01, -6.54653671e-01,
     -5.48972942e-01, -5.26656882e-01],
     [-1.00000000e+00, -5.00000000e-01, 1.52752523e+00,
     0.00000000e+00, -1.07356980e+00],
     [ 1.00000000e+00, -5.00000000e-01, -6.54653671e-01,
     1.34013983e+00, 1.38753832e+00],
     [ 1.00000000e+00, -5.00000000e-01, -6.54653671e-01,
    1.63077256e+00, 1.75214693e+00],
     [ 1.00000000e+00, -5.00000000e-01, -6.54653671e-01,
     -2.58340208e-01, 2.93712492e-01]])
from sklearn.preprocessing import MinMaxScaler
mms=MinMaxScaler(feature_range=(0,1))
mms.fit(final_set)
feat_minmax_scaler=mms.transform(final_set)
feat_minmax_scaler

    array([[1. , 0. , 0. , 0.73913043, 0.68571429],
    [0. , 0. , 1. , 0. , 0. ],
     [0. , 1. , 0. , 0.13043478, 0.17142857],
     [0. , 0. , 1. , 0.47826087, 0.37142857],
    [0. , 1. , 0. , 0.56521739, 0.45079365],
    [1. , 0. , 0. , 0.34782609, 0.28571429],
    [0. , 0. , 1. , 0.51207729, 0.11428571],
    [1. , 0. , 0. , 0.91304348, 0.88571429],
     [1. , 0. , 0. , 1. , 1. ],
     [1. , 0. , 0. , 0.43478261, 0.54285714]])
```

Lab experiments
Roll no: 230701038
Name:Arvind Ravi
Class: CSE-A III
Subject: Fundamentals of data science (CS2334)
Experiment: 07

```
import numpy as np
import pandas as pd
df=pd.read_csv("/content/pre-process_datasample.csv")  df
```

```
      Country Age Salary Purchased
    0 France 44.0 72000.0 No
    1 Spain 27.0 48000.0 Yes
    2 Germany 30.0 54000.0 No
```

```
3 Spain 38.0 61000.0 No
4 Germany 40.0 NaN Yes
5 France 35.0 58000.0 Yes  6 Spain NaN 52000.0 No
7 France 48.0 79000.0 Yes  8
NaN 50.0 83000.0 No
9 France 37.0 67000.0 Yes
```

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 10 entries, 0 to 9  Data
columns (total 4 columns):
 # Column Non-Null Count Dtype
--- ------ ------------- -----
   0    Country 9 non-null object
   1    Age 9 non-null float64
   2    Salary 9 non-null float64   3 Purchased 10
non-null object   dtypes: float64(2), object(2)
memory usage: 448.0+ bytes  df.Country.mode()
```

```
  Country  0
France
```

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

```
type(df.Country.mode())
```

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

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

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

df
```

```
  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 France 50.0 83000.0 No
9 France 37 0 67000 0 Yes
```

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

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

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

```
updated_dataset
```

```
  France Germany Spain Age Salary Purchased
0 True False False 44.0 72000.0 No
1 False False True 27.0 48000.0 Yes
2 False True False 30.0 54000.0 No
3 False False True 38.0 61000.0 No
4 False True False 40.0 63778.0 Yes
5 True False False 35.0 58000.0 Yes
6 False False True 38.0 52000.0 No
7 True False False 48.0 79000.0 Yes  8 True False False 50.0 83000.0 No
9 True False False 37 0 67000 0 Yes
```

```
df.info()
```

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

```
updated_dataset
```

```
      France Germany Spain Age Salary Purchased
    0 True False False 44.0 72000.0 0
    1 False False True 27.0 48000.0 1
    2 False True False 30.0 54000.0 0
    3 False False True 38.0 61000.0 0
    4 False True False 40.0 63778.0 1
    5 True False False 35.0 58000.0 1
    6 False False True 38.0 52000.0 0
    7 True False False 48.0 79000.0 1
    8 True False False 50.0 83000.0 0
    9 True False False 37 0 67000 0 1
```

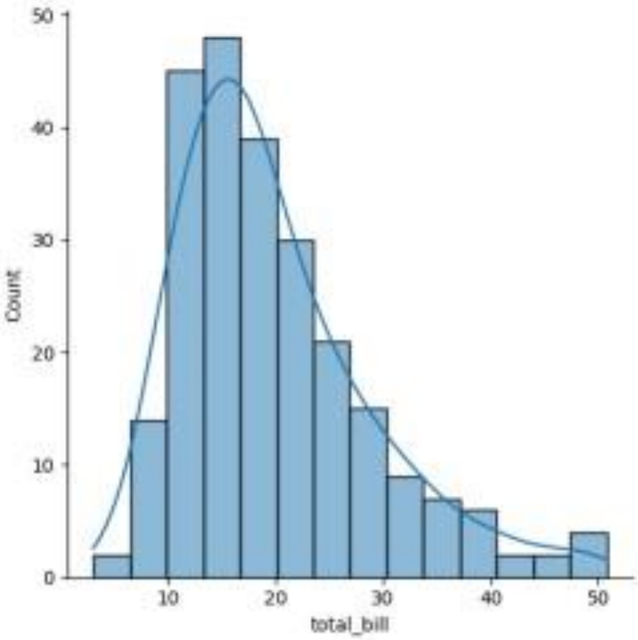
Lab experiments
Roll no: 230701038
Name: Arvind Ravi
Class: CSE-A III
Subject: Fundamentals of data science (CS2334)
Experiment: 08

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

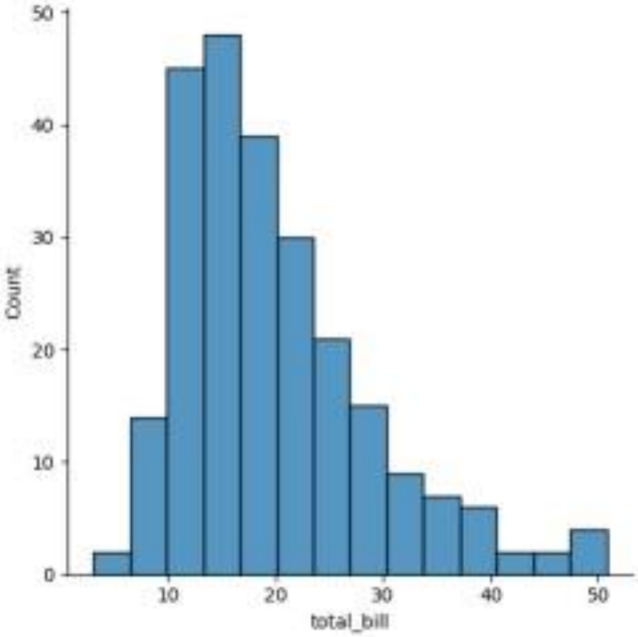
```
      total_bill tip sex smoker day time size
         0      16.99 1.01 Female No Sun Dinner 2
         1      10.34 1.66 Male No Sun Dinner 3
         2      21.01 3.50 Male No Sun Dinner 3
         3      23.68 3.31 Male No Sun Dinner 2
         4      24.59 3.61 Female No Sun Dinner 4
```

```
sns.displot(tips.total_bill,kde=True)
```

```
<seaborn.axisgrid.FacetGrid at 0x79bb4c7ea680>
```

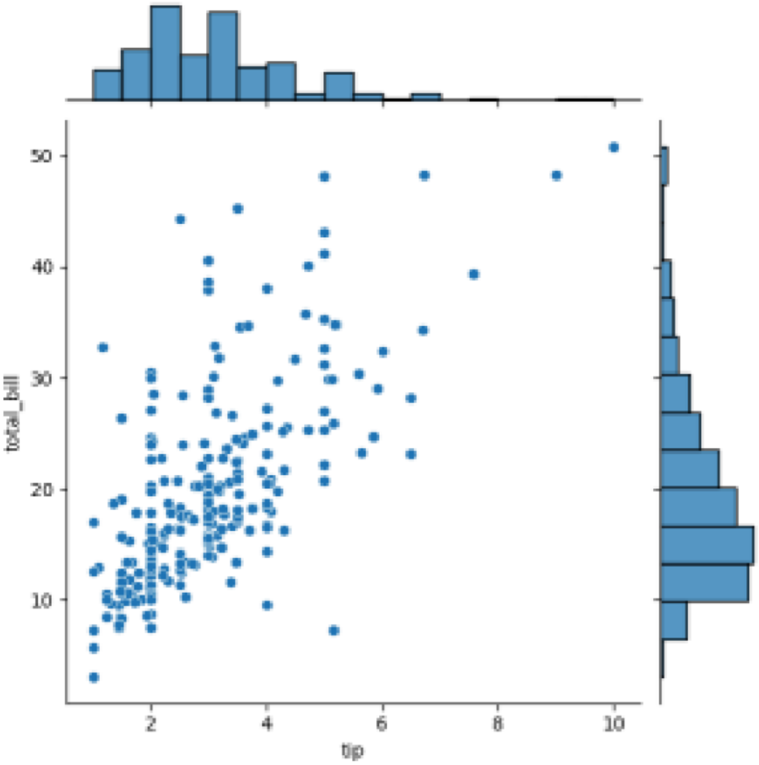


```
sns.displot(tips.total_bill,kde=False)
```

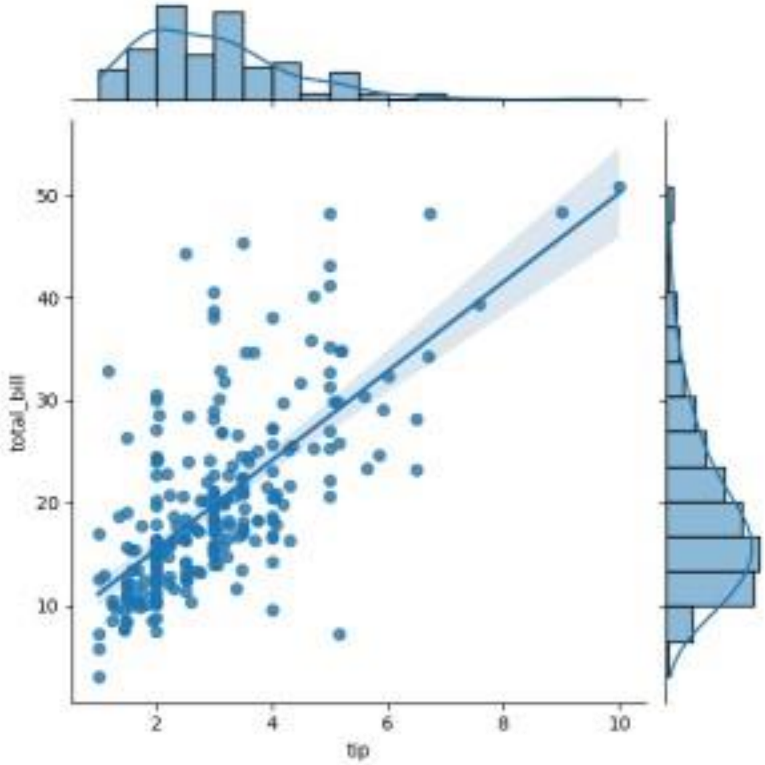


```
sns.jointplot(x=tips.tip,y=tips.total_bill)
```

```
    <seaborn.axisgrid.JointGrid at 0x79bb08fc96c0>
```

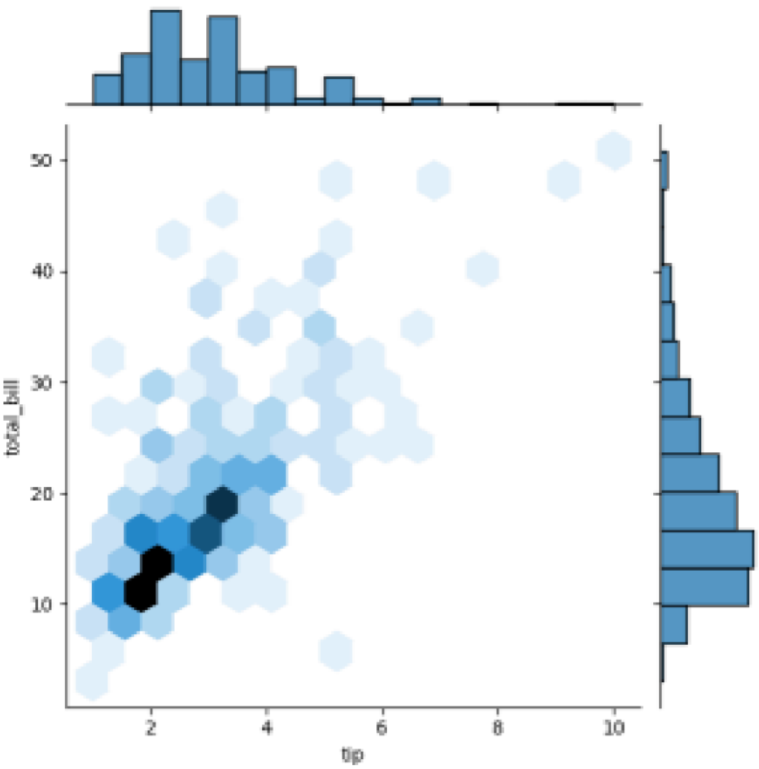


```
sns.jointplot(x=tips.tip,y=tips.total_bill,kind="reg")
```

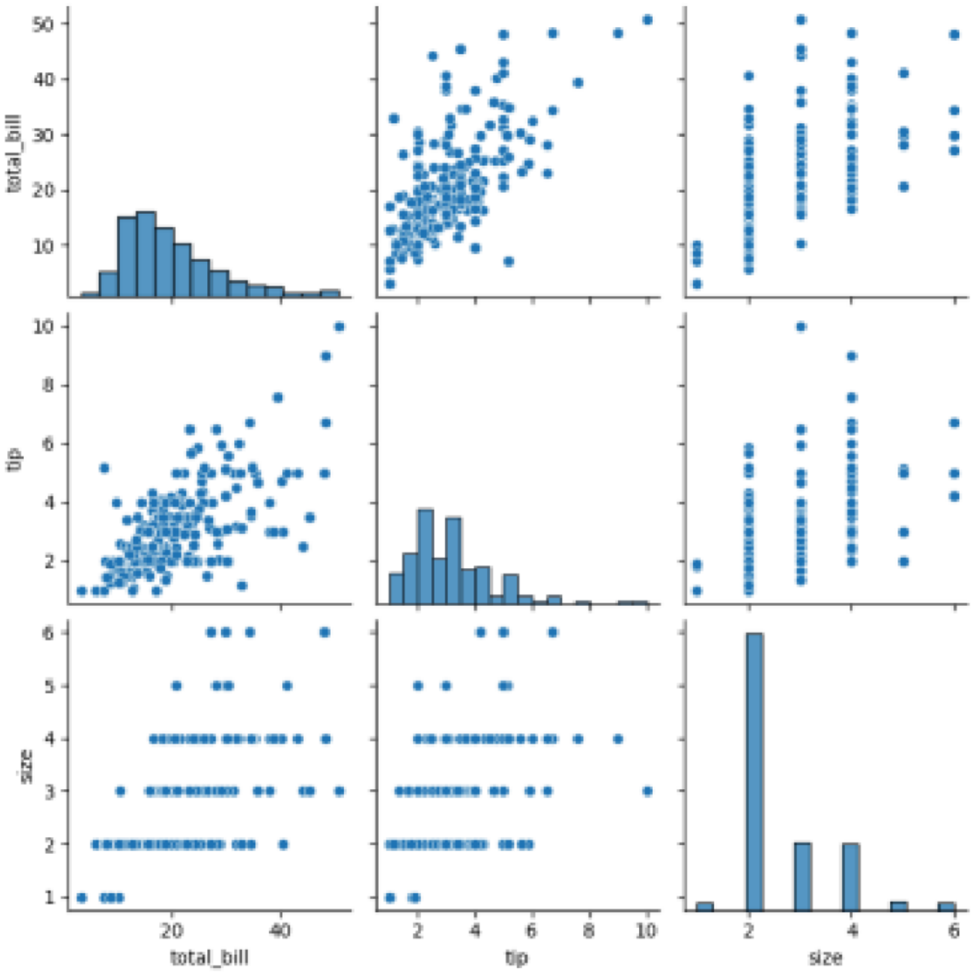


```
sns.jointplot(x=tips.tip,y=tips.total_bill,kind="hex")
```

```
<seaborn.axisgrid.JointGrid at 0x79bb088f4730>
```



```
sns.pairplot(tips)
```

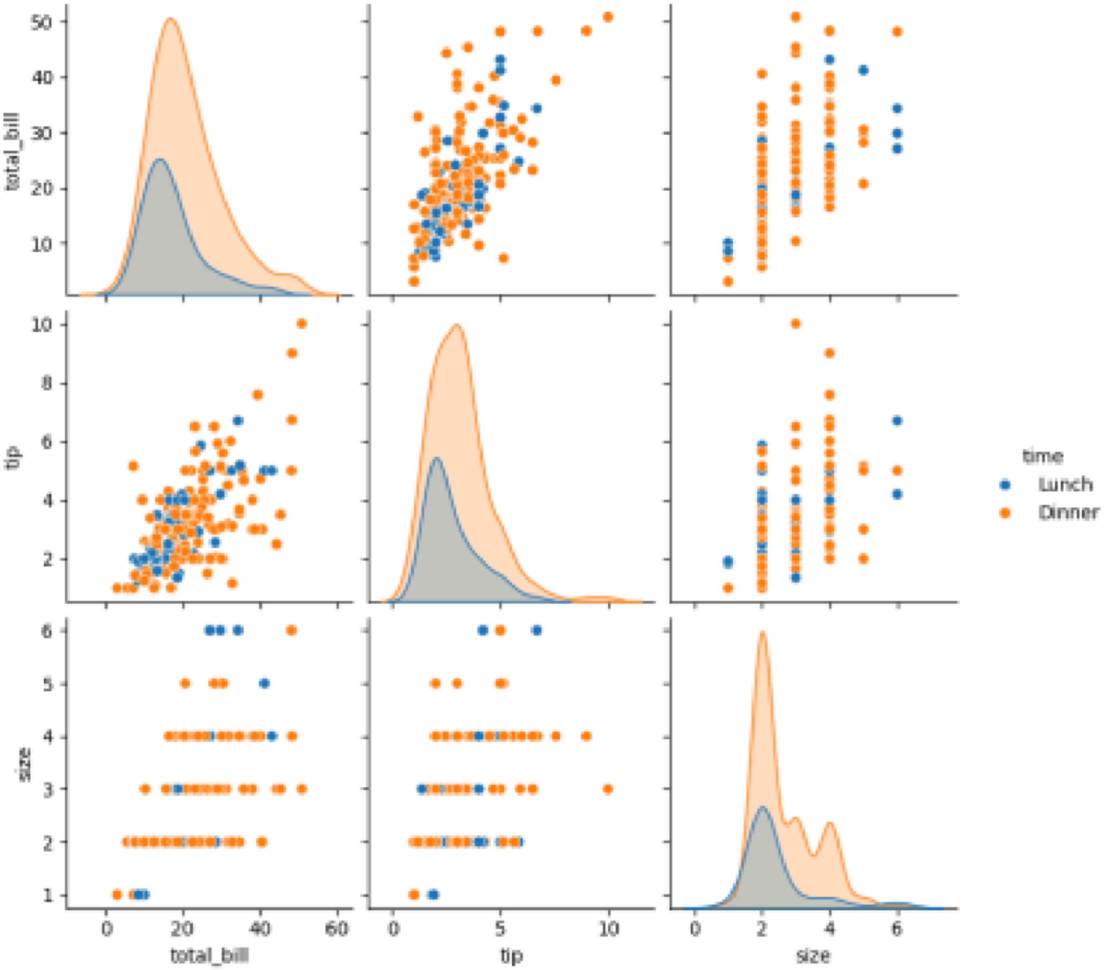


```
tips.time.value_counts()
```

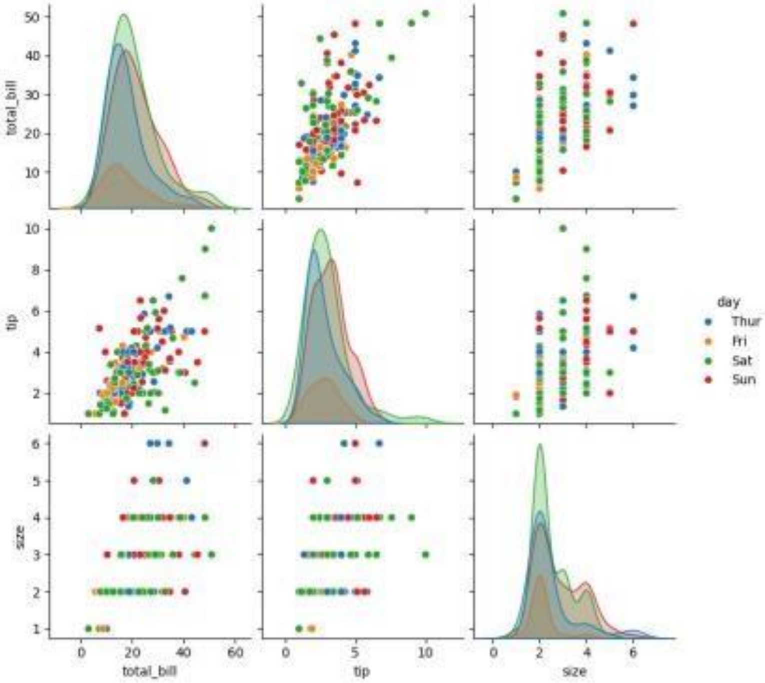
```
        count
      time
    Dinner 176
     Lunch 68  dtype:

    int64
```

```
sns.pairplot(tips,hue='time')
```

```
<seaborn.axisgrid.PairGrid at 0x79bb088f4670>
```

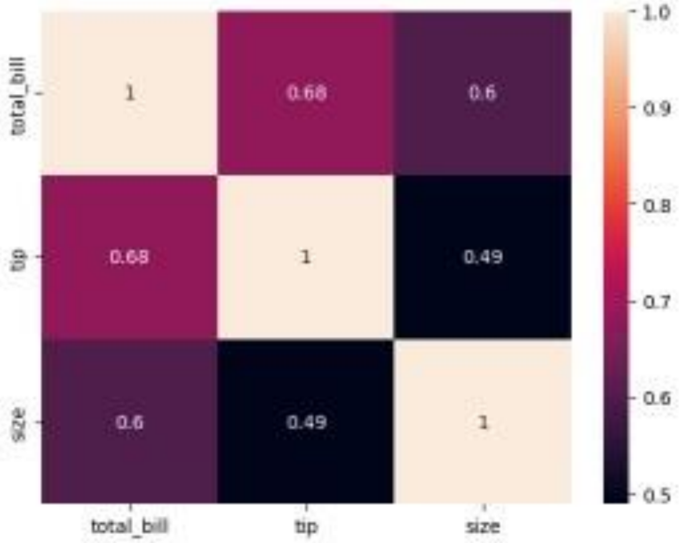


```
sns.pairplot(tips,hue='day')
```



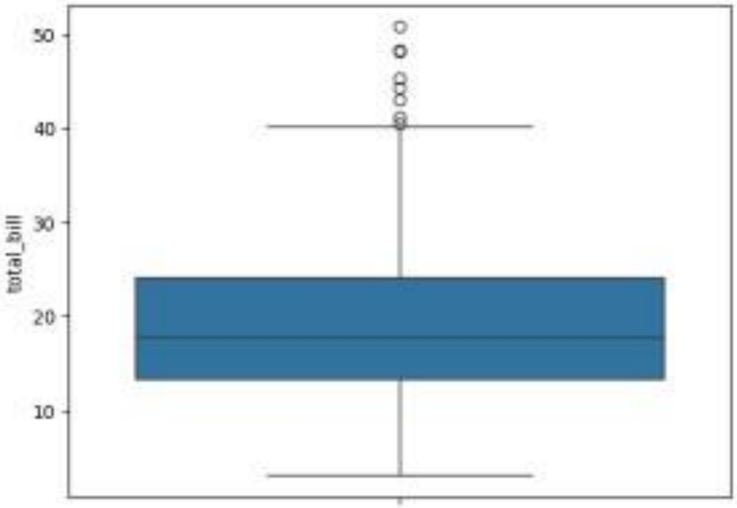
```
sns.heatmap(tips.corr(numeric_only=True),annot=True)
```

```
<Axes: >
```



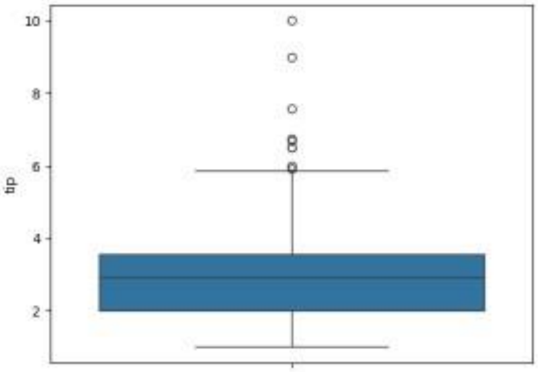
```
sns.boxplot(tips.total_bill)
```

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



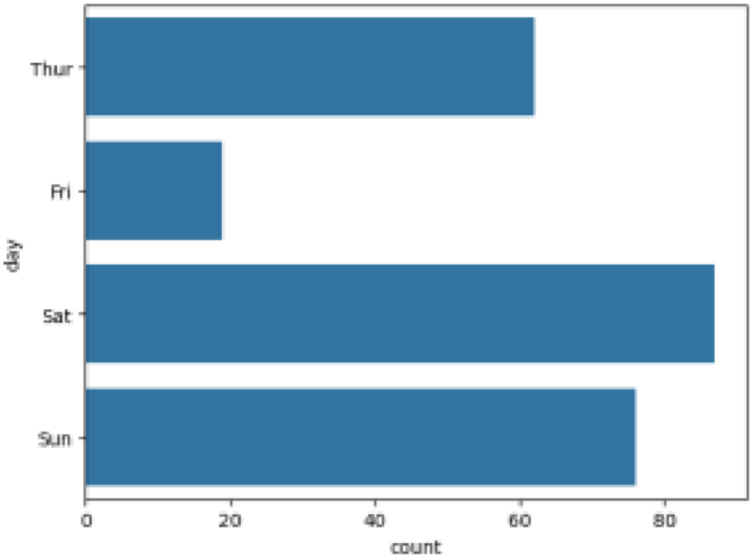
```
sns.boxplot(tips.tip)
```

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



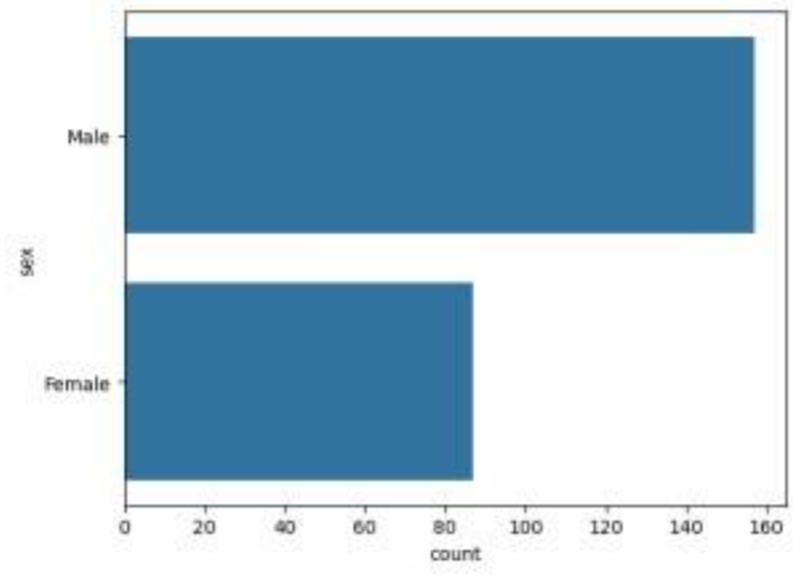
```
sns.countplot(tips.day)
```

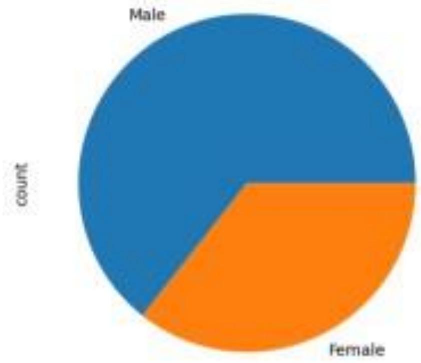
```
<Axes: xlabel='count', ylabel='day'>
```



```
sns.countplot(tips.sex)
```

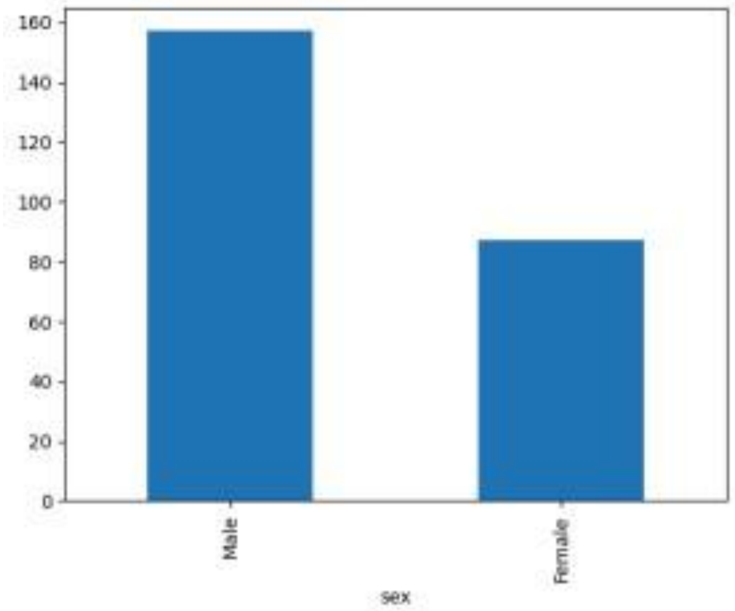
```
h<Axes: xlabel='count', ylabel='sex'>
```





```
tips.sex.value_counts().plot(kind='pie')
    <Axes: ylabel='count'>
```

```
tips.sex.value_counts().plot(kind='bar')
    <Axes: xlabel='sex'>
```



Lab experiments
Roll no: 230701038
Name: Arvind Ravi
Class: CSE-A III
Subject: Fundamentals of data science (CS2334)
Experiment: 09

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

<class 'pandas.core.frame.DataFrame'> RangeIndex: 30 entries, 0 to 29
Data columns (total 2 columns):
df.describe()
```

```
 Out[5]: Years Experience 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 [6]:  features=df.iloc[:,[0]].values
label=df.iloc[:,[1]].values
```

```
from sklearn.model_selection
import train_test_split
x_train,x_test,y_train,y_test=train_test_split(features,label,test_size=0.2,random_
st

from sklearn.linear_model

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

```
Out[20]: ▾ LinearRegression

            LinearRegression()
```

```
                   model.score(x_tr
In [21]:     ain,y_train)
```

```
Out[21]: 0.9603182547438908
```

```
                  model.score(x_t
In [23]:     est,y_test)
```

```
Out[23]: 0.9184170849214232
```

```
model.coe In [24]:  f_
```

```
Out[24]:
array([[9281.30847068]])
```

```
model.inter In [25]:  cept_
```

```
Out[25]: array([27166.73682891])
```

```
In [26]:
import pickle
pickle.dump(model,open('SalaryPred.model','wb'))

model=pickle.load(open('SalaryPred.model','rb')) yr_of_exp=float(input("Enter Years

of Experience: "))

yr_of_exp_NP=np.array([[yr_of_exp]])
Salary=model.predict(yr_of_exp_NP)
Enter Years of Experience: 44



print("Estimated Salary for {} years of experience is {}: "
.format(yr_of_exp,Salary) Estimated Salary for 44.0 years of experience is

[[435544.30953887]]:
```

Lab experiments
Roll no: 230701038
Name: Arvind Ravi
Class: CSE-A III
Subject: Fundamentals of data science (CS2334)
Experiment: 10

```
 import numpy as np
import pandas as pd

df=pd.read_csv('Iris.csv')  df.info()

df.variety.value_counts()
```

```
Out[3]: Setosa 50
        Versicolor 50
        Virginica 50
        Name: variety, dtype: int64
```

```
In [4]:  df.head()
```

Out[4]: 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

```
In [5]: In [6]: In [8]:
features=df.iloc[:,:-1].values  label=df.iloc[:,4].values

from sklearn.model_selection

import train_test_split  from sklearn.neighbors

import KNeighborsClassifier

xtrain,xtest,ytrain,ytest=train_test_split(features,label,test_size=.2,rando
model_KNN=KNeighborsClassifier(n_neighbors=5)

model_KNN.fit(xtrain,ytrain)
```

```
Out[8]: KNeighborsClassifier()
  print(model_KNN.score(xtrain,ytrain))
print(model_KNN.score(xtest,ytest))
```

```
0.9583333333333334
1.0
```

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

```
Out[10]: array([[50, 0, 0],
           [ 0, 47, 3],
           [ 0, 2, 48]], dtype=int64) from sklearn.metrics import
   classification_report
   print(classification_report(label,model_KNN.predict(features))
   )   precision recall f1-score support

    Setosa 1.00 1.00 1.00 50 Versicolor 0.96 0.94 0.95 50  Virginica
   0.94 0.96 0.95 50

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

Lab experiments
Roll no: 2307010138
Name: Arvind Ravi Class: CSE-A III
Subject: Fundamentals of data science (CS2334)
Experiment: 11

```
In [1]:  import numpy as np  import pandas
as pd
df=pd.read_csv('Social_Network_Ads.csv') df
```

Out[1]: **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 [2]:  df.head()
```

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

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

```
In [5]:  label
```

```
Out[5]: array([0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 1, 1, 1, 1, 1, 1,  1,
         1, 1, 1, 1, 1, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,  0, 0, 0,
         0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0,  0, 0, 0, 0, 0,
         0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0,  0, 0, 0, 0, 0, 0, 0,
         0, 0, 1, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0,  0, 0, 0, 0, 0, 0, 0, 0, 0,
         0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,  0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0,
            0, 0, 1, 0, 0, 0, 0, 0, 0, 0,  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   [6]:       from   sklearn.model_selection   import
train_test_split
from sklearn.linear_model import LogisticRegression

for i in range(1,401):

x_train,x_test,y_train,y_test=train_test_split(features,labe
l,test_size=0.  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 0.6875 Train0.63125 Random State 3
Test 0.7375 Train0.61875 Random State 4
Test 0.6625 Train0.6375 Random State 5
Test 0.65 Train0.640625 Random State 6
Test 0.675 Train0.634375 Random State 7
Test 0.675 Train0.634375 Random State 8
Test 0.65 Train0.640625 Random State 10
Test 0.6625 Train0.6375 Random State 11
Test 0.7125 Train0.625 Random State 13
Test 0.675 Train0.634375 Random State 16
Test 0.7 Train0.628125 Random State 17
Test 0.7 Train0.628125 Random State 21
Test 0.65 Train0.640625 Random State 24
Test 0.6625 Train0.6375 Random State 25
Test 0.75 Train0.615625 Random State 26
Test 0.675 Train0.634375 Random State 27  Test
0.7 Train0.628125 Random State 28
Test 0.6875 Train0.63125 Random State 29
Test 0.6875 Train0.63125 Random State 31  T
t 0 6625 T i 0 6375 R d St t 37
```

```
x_train,x_test,y_train,y_test=train_test_split(features,labe
l,test_size=0.2, finalModel=LogisticRegression()
finalModel.fit(x_train,y_train)
```

```
Out[8]: LogisticRegression()
```

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

print(finalModel.score(x_test,y_test))

0.834375
0.9125
```

```
from sklearn.metrics import classification_report

print(classification_report(label,finalModel.predict(features))

)   precision recall f1-score support   0 0.85 0.93 0.89 257  1

0.84 0.71 0.77 143

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

Lab experiments
Roll no: 230701038
Name: Arvind Ravi
Class: CSE-A III
Subject: Fundamentals of data science (CS2334)
Experiment: 12

```
 import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
 import seaborn as sns
 %matplotlib inline
 df=pd.read_csv('Mall_Customers
 .csv')  df.info()
 <class 'pandas.core.frame.DataFrame'>  RangeIndex:
 200 entries, 0 to 199
 Data columns (total 5 columns):
 df.head()
```

Out[4]: **CustomerID Gender Age Annual Income (k$) Spending Score (1-100)**

0 1 Male 19 15 39

1 2 Male 21 15 81

2 3 Female 20 16 6

3 4 Female 23 16 77

4 5 Female 31 17 40

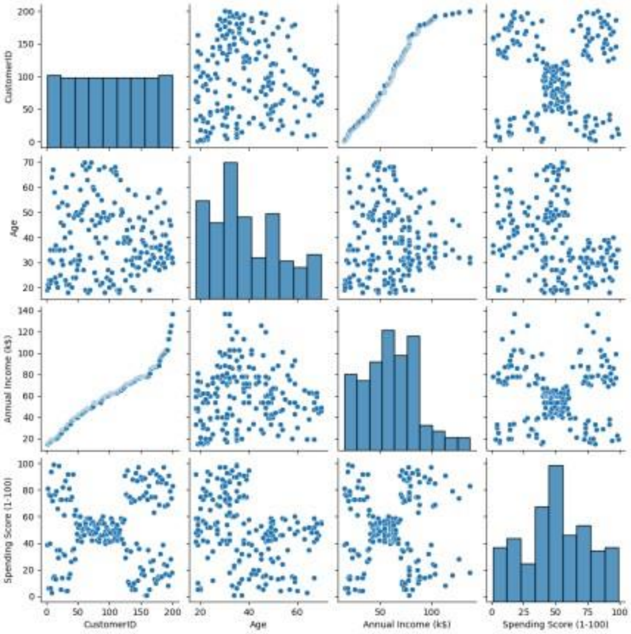
```
sns.pairplot(df)
```

In [5]:

Out[5]: <seaborn.axisgrid.PairGrid at 0x170e8e47850>

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

In [6]:



In [7]:

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

Out[7]: KMeans(n_clusters=5)

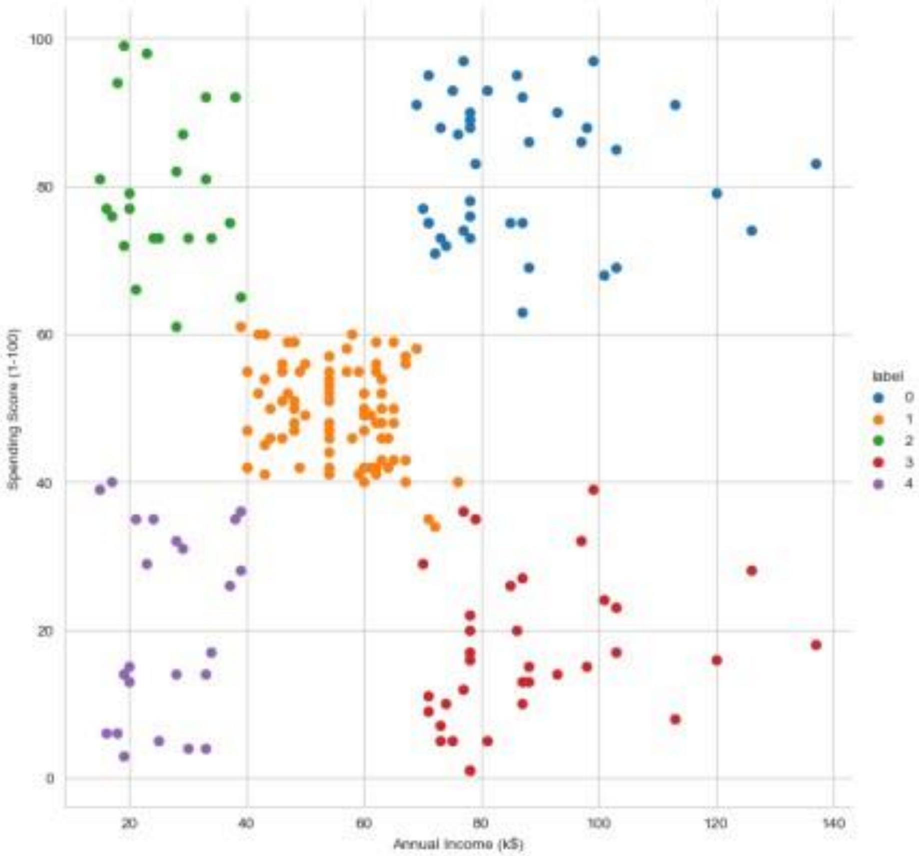
In [8]:

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

```
    Final.head()
    Final['label']=model.predict(features)
```

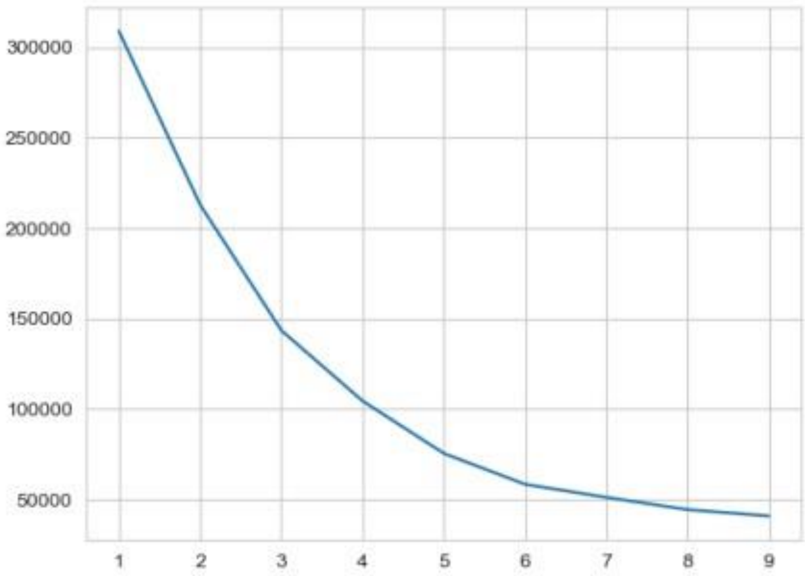
```
Out[8]: Annual Income (k$) Spending Score (1-100) label

         0 15 39 4

         1 15 81 2  2 16 6 4

         3 16 77 2

         4 17 40 4
```

```
In [9]: sns.set_style("whitegrid")  sns.FacetGrid(Final,hue="label",height=8)
\
.map(plt.scatter,"Annual Income (k$)", "Spending Score (1-100)") \
.add_legend();
plt.show()
```



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

```
Out[10]: [<matplotlib.lines.Line2D at 0x170e99f3550>]
```

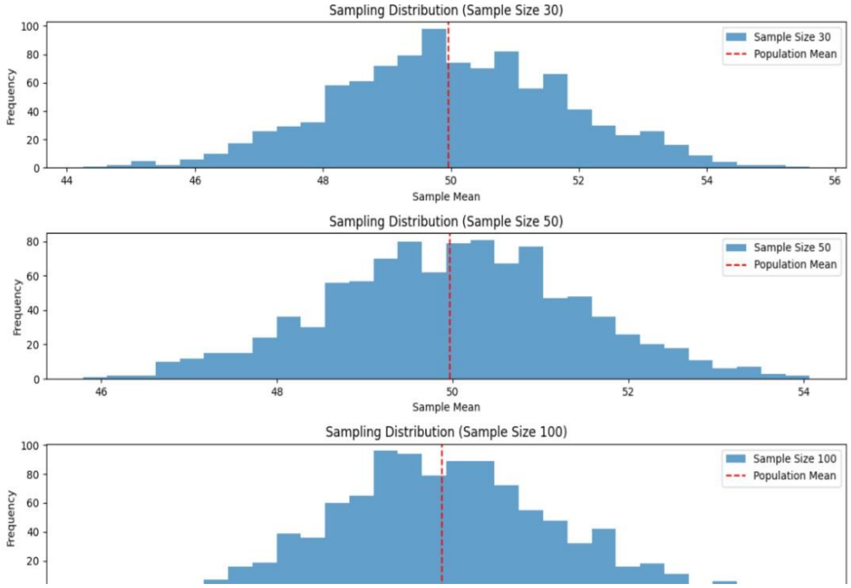


Lab experiments
Roll no: 230701038
Name: Arvind Ravi
Class: CSE-A III
Subject: Fundamentals of data science (CS2334)
Experiment: 13

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

# Step 1: Generate a population (e.g., normal distribution) population_mean =
50
population_std = 10
```

```
population_size = 100000
population = np.random.normal(population_mean, population_std,
population_size)
# Step 2: Random sampling
sample_sizes = [30, 50, 100r num_samples = 1000
 sample_means =
{}
for size in
sample_sizes:
sample_means[siz
e] = []

for _ in
range(num_sample
s):
        sample = np.random.choice(population, size=size,replace=False)

sample_means[size].append(np.mean(sample))


plt.figure(figsize=(12, 8))
 for i, size in enumerate(sample_sizes):
              plt.subplot(len(sample_sizes), 1, i+1)
              plt.hist(sample_means[size], bins=30, alpha=0.7, label=f'Sample Size
              {size}')
              plt.axvline(np.mean(population), color='red', linestyle='dashed',
              linewidth=1.5, label='Population Mean')
              plt.title(f'Sampling Distribution (Sample Size {size})')
              plt.xlabel('Sample Mean')
              plt.ylabel('Frequency')
              plt.legend()

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

OUTPUT:



Lab experiments

Roll no: 230701038
Name: Arvind Ravi
Class: CSE-A III
Subject: Fundamentals of data science (CS2334)
Experiment: 13

```
import numpy as np import

 scipy.stats as stats

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])

population_mean = 150

sample_mean = np.mean(sample_data)

sample_std = np.std(sample_data, ddof=1)

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)))

print(f"Sample Mean: {sample_mean:.2f}")

print(f"Z-Statistic: {z_statistic:.4f}")
print(f"P-Value:{p_value:.4f}")

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

```
OUTPUT:

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.
```

Lab experiments
Roll no: 230701038
Name: Arvind Ravi
Class: CSE-A III
Subject: Fundamentals of data science (CS2334)
Experiment: 14

```
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)

# Mean IQ of 102, SD of 15

hypothesis population_mean = 100

sample_mean = np.mean(sample_data) sample_std = np.std(sample_data, ddof=1)

n = len(sample_data)

p_value = stats.ttest_1samp(sample_data, population_mean)
```

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

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.")
```

OUTPUT:

```
Sample Mean: 99.56
T-Statistic: -0.1578
P-Value: 0.8761
Fail to reject the null hypothesis: There is no significant difference in average
IQ score from 100.
```

Lab experiments
Roll no: 230701038
Name: Arvind Ravi
Class: CSE-A III
Subject: Fundamentals of data science (CS2334)
Experiment: 15

```
import numpy as np
import scipy.stats as stats

np.random.seed(42)

(A, B, C) 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)

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

treatment_labels = ['A'] * n_plants + ['B'] * n_plants + ['C'] * n_plants

p_value = stats.f_oneway(growth_A, growth_B, growth_C)

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

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:    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)
```

```
OUTPUT:
Treatment A Mean Growth: 9.672983882683818
Treatment B Mean Growth: 11.137680744437432
Treatment C Mean Growth: 15.265234904828972

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.
```