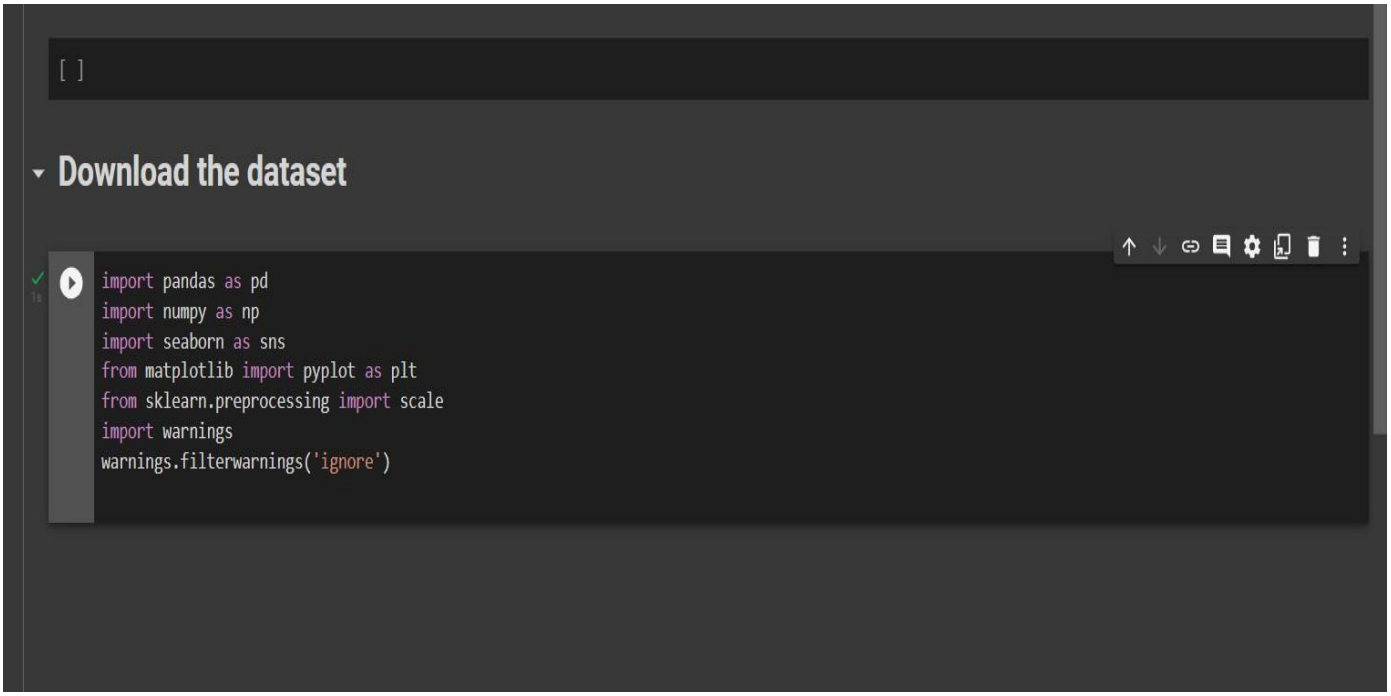
ASSIGNMENT-04

Assignment Date	2 November 2022
Student Name	Sahithya V
Student Roll Number	113219071034
Maximum Marks	2 Marks

Problem Statement: Customer Segmentation Analysis



load the dataset into the tool

```
[ ] data=pd.read_csv("drive/MyDrive/CONTENT/Mall_Customers.csv")
    data.head()
```

	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

```
[ ] data.shape
```

```
(200, 5)
```

```
[ ] data.size
```

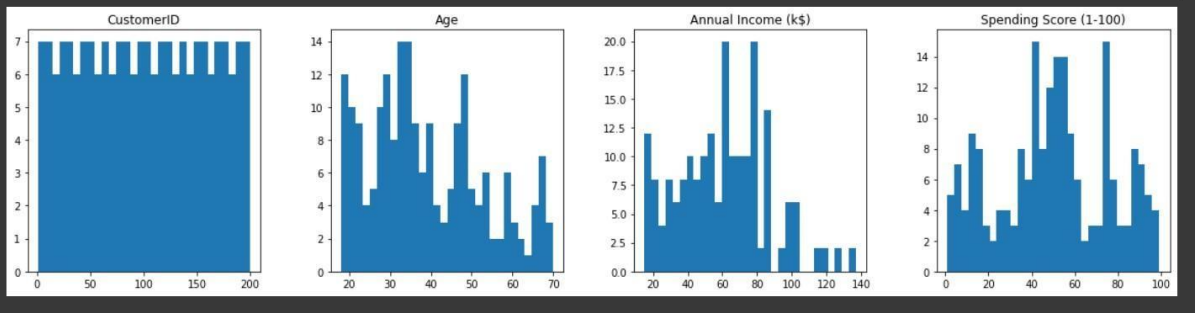
```
1000
```

```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 200 entries, 0 to 199
Data columns (total 5 columns):
 #   Column                  Non-Null Count  Dtype
---  ------                  --------------  -----
 0   CustomerID              200 non-null    int64
 1   Gender                  200 non-null    object
 2   Age                     200 non-null    int64
 3   Annual Income (k$)      200 non-null    int64
 4   Spending Score (1-100)  200 non-null    int64
dtypes: int64(4), object(1)
memory usage: 7.9+ KB
```

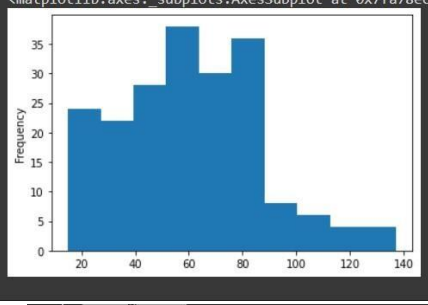
Perform Below Visulizations

```
[ ]
    data.hist(figsize=(20,10), grid=False, layout=(2,4),bins=30)
    plt.show()
```



```
[ ]  data["Annual Income (k$)"].plot(kind='hist')
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fa78eca9290>
```



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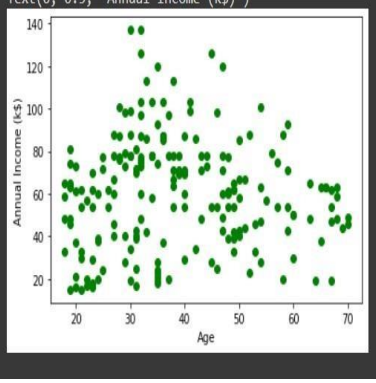
```
[ ]  from matplotlib import pyplot as plt
     plt.scatter(data['Age'],data['Annual Income (k$)'],color='green')
     plt.xlabel("Age")
     plt.ylabel("Annual Income (k$)")
```

```
Text(0, 0.5, 'Annual Income (k$)')
```



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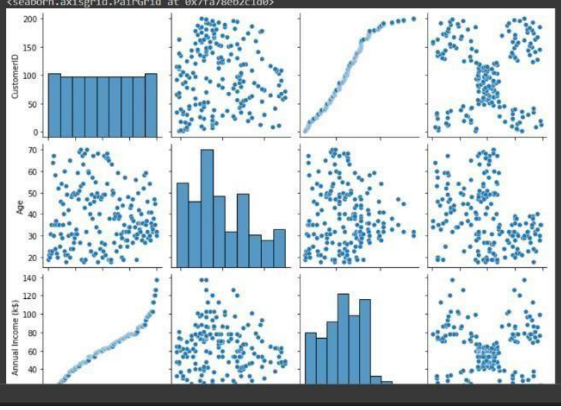
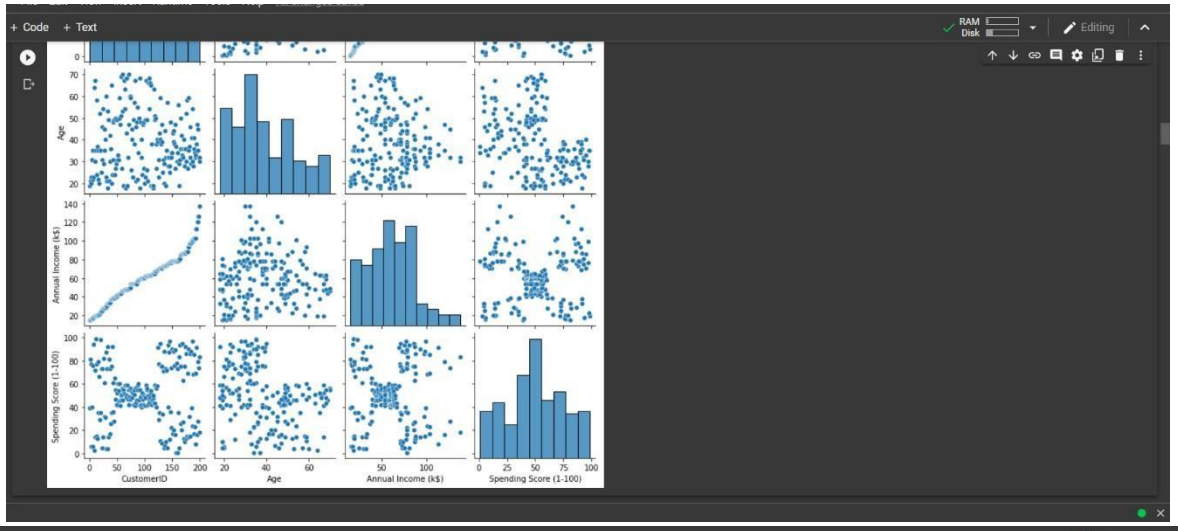
```
sns.pairplot(data)
```

```
<seaborn.axisgrid.PairGrid at 0x7fa78eb2c1d0>
```





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Perform descriptive statistics on the dataset

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

	CustomerID	Age	Annual Income (k$)	Spending Score (1-100)
count	200.000000	200.000000	200.000000	200.000000
mean	100.500000	38.850000	60.560000	50.200000
std	57.879185	13.969007	26.264721	25.823522
min	1.000000	18.000000	15.000000	1.000000
25%	50.750000	28.750000	41.500000	34.750000
50%	100.500000	36.000000	61.500000	50.000000
75%	150.250000	49.000000	78.000000	73.000000
max	200.000000	70.000000	137.000000	99.000000

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RAM Disk Editing

Check for Missing values and deal with them

```
[ ] data.isna().sum()
```

```
CustomerID              0
Gender                  0
Age                     0
Annual Income (k$)      0
Spending Score (1-100)  0
dtype: int64
```

Find the outliers and replace them outliers.

```
[ ] data.skew()
```

```
CustomerID              0.000000
Age                     0.485569
Annual Income (k$)      0.321843
Spending Score (1-100) -0.047220
dtype: float64
```

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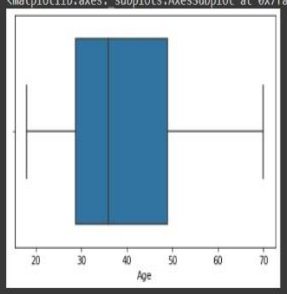
RAM Disk Editing

```
[ ] sns.boxplot(x=data['Age'],data=data)
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fa78f3fd150>
```



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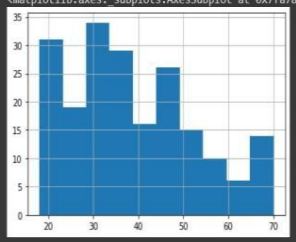
```
[ ] data['Age'].hist()
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fa78f493b50>
```




```
[ ] print('skewness value of Age:',data['Age'].skew())
```

```
skewness value of Age: 0.48556885096681657
```

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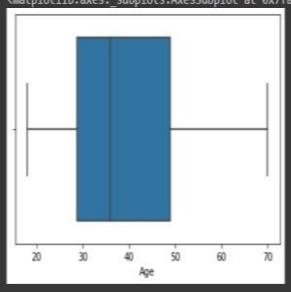
RAM Disk Editing

```
[ ] sns.boxplot(x=data['Age'],data=data)
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fa78a6a0550>
```



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Check for Categorical columns and encoding

```
[ ] data.info
```

```
<bound method DataFrame.info of      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
..          ...     ...  ...                 ...                     ...
195         196  Female   35                 120                      79
196         197  Female   45                 126                      28
197         198    Male   32                 126                      74
198         199    Male   32                 137                      18
199         200    Male   30                 137                      83

[200 rows x 5 columns]>
```

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RAM Disk Editing

```
[ ] from sklearn.preprocessing import LabelEncoder
    le=LabelEncoder()
    data['Gender']=le.fit_transform(data['Gender'])
    data.head()
```

	CustomerID	Gender	Age	Annual Income (k$)	Spending Score (1-100)
0	1	1	19	15	39
1	2	1	21	15	81
2	3	0	20	16	6
3	4	0	23	16	77
4	5	0	31	17	40

```
[ ] data["Gender"].unique()
```

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

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RAM Disk | Editing

Scaling the Data

```
x=data.drop(columns=['Gender','Age'])
print(x)
```

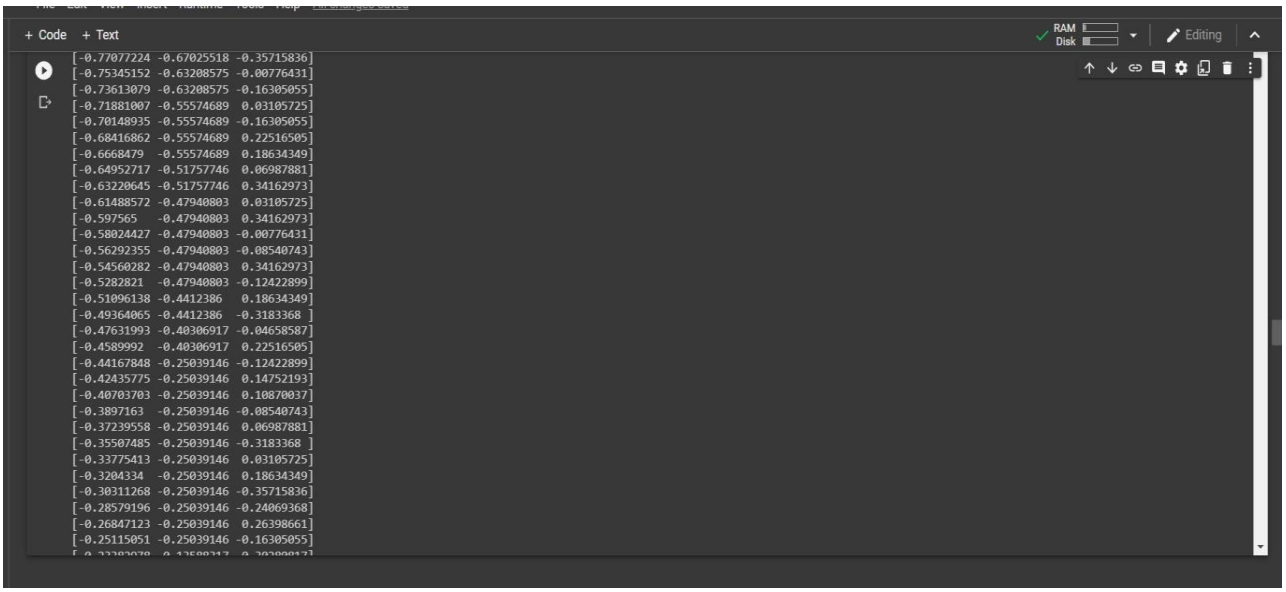
```
     CustomerID  Annual Income (k$)  Spending Score (1-100)
0             1                  15                      39
1             2                  15                      81
2             3                  16                       6
3             4                  16                      77
4             5                  17                      40
..          ...                 ...                     ...
195         196                 120                      79
196         197                 126                      28
197         198                 126                      74
198         199                 137                      18
199         200                 137                      83

[200 rows x 3 columns]
```

```
[ ] S=scale(x)
    print(S)
```

```
[[-1.7234121  -1.73899919 -0.43480148]
 [-1.70609137 -1.73899919  1.19570407]
 [-1.68877065 -1.70082976 -1.71591298]
 [-1.67144992 -1.70082976  1.04041783]
 [-1.6541292  -1.66266033 -0.39597992]
```


```
[[-1.7234121  -1.73899919 -0.43480148]
 [-1.70609137 -1.73899919  1.19570407]
 [-1.68877065 -1.70082976 -1.71591298]
 [-1.67144992 -1.70082976  1.04041783]
 [-1.6541292  -1.66266033 -0.39597992]
 [-1.63680847 -1.66266033  1.00159627]
 [-1.61948775 -1.62449091 -1.71591298]
 [-1.60216702 -1.62449091  1.70038436]
 [-1.5848463  -1.58632148 -1.83237767]
 [-1.56752558 -1.58632148  0.84631002]
 [-1.55020485 -1.58632148 -1.4053405 ]
 [-1.53288413 -1.58632148  1.89449216]
 [-1.5155634  -1.54815205 -1.36651894]
 [-1.49824268 -1.54815205  1.04041783]
 [-1.48092195 -1.54815205 -1.44416206]
 [-1.46360123 -1.54815205  1.11806095]
 [-1.4462805  -1.50998262 -0.59008772]
 [-1.42895978 -1.50998262  0.61338066]
 [-1.41163905 -1.43364376 -0.82301709]
 [-1.39431833 -1.43364376  1.8556706 ]
 [-1.3769976  -1.39547433 -0.59008772]
 [-1.35967688 -1.39547433  0.88513158]
 [-1.34235616 -1.3573049  -1.75473454]
 [-1.32503543 -1.3573049   0.88513158]
 [-1.30771471 -1.24279661 -1.4053405 ]
 [-1.29039398 -1.24279661  1.23452563]
 [-1.27307326 -1.24279661 -0.7065524 ]
 [-1.25575253 -1.24279661  0.41927286]
 [-1.23843181 -1.20462718 -0.74537397]
 [-1.22111108 -1.20462718  1.42863343]
```

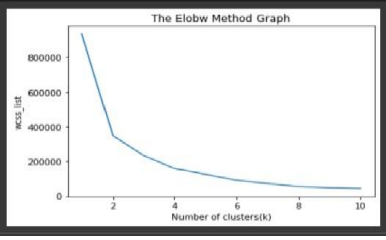


```
[ 0.35507485  0.24581112  0.22516505]
[ 0.37239558  0.24581112 -0.39597992]
[ 0.3897163   0.32214998  0.30280817]
[ 0.40703703  0.32214998  1.58391968]
[ 0.42435775  0.36031941 -0.82301709]
[ 0.44167848  0.36031941  1.04041783]
[ 0.4589992   0.39848884 -0.59008772]
[ 0.47631993  0.39848884  1.73920592]
[ 0.49364065  0.39848884 -1.52180518]
[ 0.51096138  0.39848884  0.96277471]
[ 0.5282821   0.39848884 -1.5994483 ]
[ 0.54560282  0.39848884  0.96277471]
[ 0.56292355  0.43665827 -0.62890928]
[ 0.58024427  0.43665827  0.80748846]
[ 0.597565    0.4748277  -1.75473454]
[ 0.61488572  0.4748277   1.46745499]
[ 0.63220645  0.4748277  -1.67709142]
[ 0.64952717  0.4748277   0.88513158]
[ 0.6668479   0.51299713 -1.56062674]
[ 0.68416862  0.51299713  0.84631002]
[ 0.70148935  0.55116656 -1.75473454]
[ 0.71881007  0.55116656  1.6615628 ]
[ 0.73613079  0.58933599 -0.39597992]
[ 0.75345152  0.58933599  1.42863343]
[ 0.77077224  0.62750542 -1.48298362]
[ 0.78809297  0.62750542  1.81684904]
[ 0.80541369  0.62750542 -0.55126616]
[ 0.82273442  0.62750542  0.92395314]
[ 0.84005514  0.66567484 -1.09476801]
[ 0.85737587  0.66567484  1.54509812]
[ 0.87469659  0.66567484 -1.28887582]
[ 0.89201732  0.66567484  1.46745499]
```

Perform any of the clustering algorithms

```
from sklearn.cluster import KMeans
wcss_list= [] #Initializing the list for the values of WCSS

#Using for loop for iterations from 1 to 10.
for i in range(1, 11):
 kmeans = KMeans(n_clusters=i, init='k-means++', random_state= 42)
 kmeans.fit(x)
 wcss_list.append(kmeans.inertia_)
plt.plot(range(1, 11), wcss_list)
plt.title('The Elobw Method Graph')
plt.xlabel('Number of clusters(k)')
plt.ylabel('wcss_list')
plt.show()
```



Add the cluster data with the primary dataset

```
kmeans = KMeans(n_clusters=5, init='k-means++', random_state= 42)
clus= kmeans.fit_predict(S)
clus
```

```
array([2, 3, 2, 3, 2, 3, 2, 3, 2, 3, 2, 3, 2, 3, 2, 3, 2, 3, 2, 3,
       2, 3, 2, 3, 2, 3, 2, 3, 2, 3, 2, 3, 2, 3, 2, 3, 2, 3, 2, 3,
       2, 3, 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, 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, 0, 0, 0, 0, 0, 0, 4, 1, 4, 1, 4, 1, 4, 1,
       1, 4, 1, 4, 1, 4, 1, 4, 1, 4, 1, 4, 1, 4, 1, 4, 1, 4, 1, 4,
       1, 4, 1, 4, 1, 4, 1, 4, 1, 4, 1, 4, 1, 4, 1, 4, 1, 4, 1, 4,
       1, 4, 1, 4, 1, 4, 1, 4, 1, 4, 1, 4, 1, 4, 1, 4, 1, 4, 1, 4,
       1, 4], dtype=int32)
```

Split the data into dependent and independent variables

```
x=data.drop(columns=['Annual Income (k$)'],axis=1)
print(x)
```

```
     CustomerID  Gender  Age  Spending Score (1-100)
0             1       1   19                      39
1             2       1   21                      81
2             3       0   20                       6
3             4       0   23                      77
4             5       0   31                      40
..          ...     ...  ...                     ...
195         196       0   35                      79
196         197       0   45                      28
197         198       1   32                      74
198         199       1   32                      18
199         200       1   30                      83

[200 rows x 4 columns]
```

```
y=data['Annual Income (k$)']
y
```

```
0      15
1      15
2      16
3      16
4      17
```

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```
[ ] y=data['Annual Income (k$)']
    y
```

```
0       15
1       15
2       16
3       16
4       17
      ...
195    120
196    126
197    126
198    137
199    137
Name: Annual Income (k$), Length: 200, dtype: int64
```

Split the data into training and testing

```
[ ] from sklearn.model_selection import train_test_split
    x_train, x_test,y_train,y_test = train_test_split(x,y, test_size = 0.3,random_state=1)
    x_train
```

	CustomerID	Gender	Age	Spending Score (1-100)
116	117	0	63	43
67	68	0	68	48

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[ ]

18	19	1	52	29
11	12	0	35	99
89	90	0	50	46
110	111	1	65	52
118	119	0	51	43
159	160	0	30	73
35	36	0	21	81
136	137	0	44	7
59	60	1	53	46
51	52	1	33	60
16	17	0	35	35
44	45	0	49	28
94	95	0	32	42
31	32	0	21	73
162	163	1	19	5
38	39	0	36	26
28	29	0	40	31
193	194	0	38	91
27	28	1	35	61

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```
[ ] x_test.shape
```

```
(60, 4)
```

```
[ ] y_train
```

```
116    65
67     48
78     54
42     39
17     21
      ..
133    72
137    73
72     50
140    75
37     34
Name: Annual Income (k$), Length: 140, dtype: int64
```

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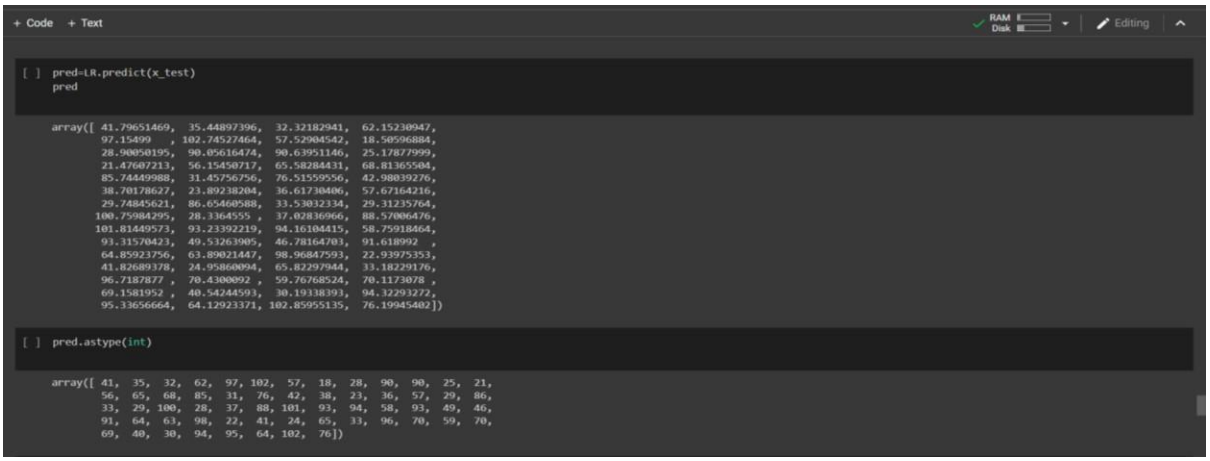
Build the model

```
[ ] from sklearn.linear_model import LinearRegression
    LR = LinearRegression()
```

Train the Model

```
[ ] LR.fit(x_train,y_train)
```

```
LinearRegression()
```



```
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[ ] pred=LR.predict(x_test)
    pred

array([ 41.79651469,  35.44897396,  32.32182941,  62.15230947,
        97.15499   , 102.74527464,  57.52904542,  18.50596884,
        28.90050195,  90.05616474,  90.63951146,  25.17877999,
        21.47607213,  56.15450717,  65.58284431,  68.81365504,
        85.74449988,  31.45756756,  76.51559556,  42.98039276,
        38.70178627,  23.89238204,  36.61730406,  57.67164216,
        29.74845621,  86.65460588,  33.53032334,  29.31235764,
       100.75984295,  28.3364555 ,  37.02836966,  88.57006476,
       101.81449573,  93.23392219,  94.16104415,  58.75918464,
        93.31570423,  49.53263905,  46.78164703,  91.618992  ,
        64.85923756,  63.89021447,  98.96847593,  22.93975353,
        41.82689378,  24.95860094,  65.82297944,  33.18229176,
        96.7187877 ,  70.4300092 ,  59.76768524,  70.1173078 ,
        69.1581952 ,  40.54244593,  30.19338393,  94.32293272,
        95.33656664,  64.12923371, 102.85955135,  76.19945402])

[ ] pred.astype(int)

array([ 41,  35,  32,  62,  97, 102,  57,  18,  28,  90,  90,  25,  21,
        56,  65,  68,  85,  31,  76,  42,  38,  23,  36,  57,  29,  86,
        33,  29, 100,  28,  37,  88, 101,  93,  94,  58,  93,  49,  46,
        91,  64,  63,  98,  22,  41,  24,  65,  33,  96,  70,  59,  70,
        69,  40,  30,  94,  95,  64, 102,  76])
```

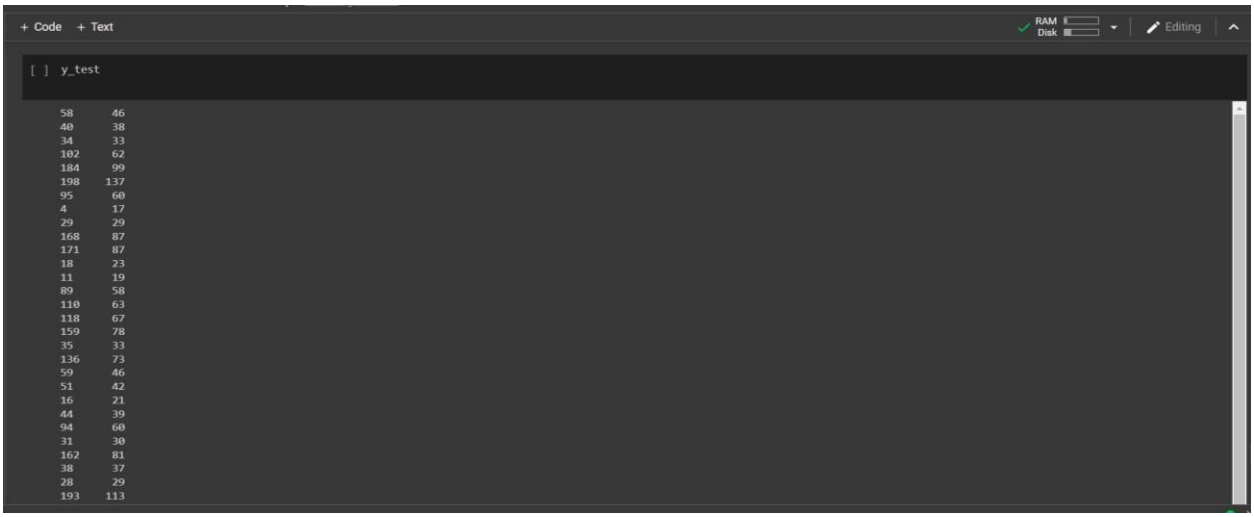

```
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[ ] y_test

58     46
40     38
34     33
102    62
184    99
198   137
95     60
4      17
29     29
168    87
171    87
18     23
11     19
89     58
110    63
118    67
159    78
35     33
136    73
59     46
51     42
16     21
44     39
94     60
31     30
162    81
38     37
28     29
193   113
```

```
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[ ] 38     37
    28     29
    193   113
    27     28
    47     40
    165    85
    194   120
    177    88
    176    88
    97     60
    174    88
    73     50
    69     48
    172    87
    108    63
    107    63
    189   103
    14     20
    56     44
    19     23
    114    65
    39     37
    185    99
    124    70
    98     61
    123    69
    119    67
    53     43
    33     33
    179    93
    181    97
    106    63
```

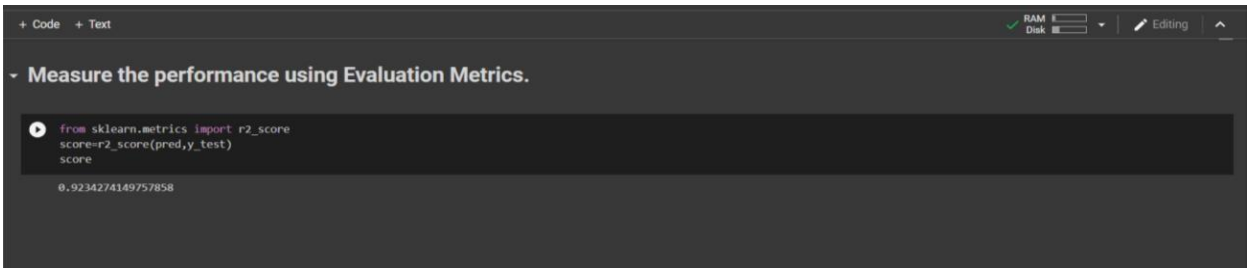

```
+ Code + Text                                                    RAM Disk   Editing

## Measure the performance using Evaluation Metrics.

from sklearn.metrics import r2_score
score=r2_score(pred,y_test)
score

0.923427414975785 8
```