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RAM
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```
from google.colab import drive
drive.mount('/content/drive')
```

```
Drive already mounted at /content/drive; to attempt to forcibly remount, call drive.mount("/content/drive", force_remount=True).
```

```
[2] import numpy as np
    import pandas as pd
    from pandas import plotting
    import matplotlib.pyplot as plt
    import seaborn as sns
    import plotly as py
    import plotly.graph_objs as go
    from sklearn.cluster import KMeans
    import warnings
    import os
    warnings.filterwarnings("ignore")
    py.offline.init_notebook_mode(connected = True)
    plt.style.use('fivethirtyeight')
    import matplotlib.pyplot as plt
    import seaborn as sns
    plt.style.use('fivethirtyeight')
    import plotly.offline as py
    from plotly.offline import init_notebook_mode, iplot
    import plotly.graph_objs as go
```

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[2] 3s
```
from plotly import tools
init_notebook_mode(connected = True)
import plotly.figure_factory as ff
import seaborn as sns
plt.style.use('ggplot')
```

0s
```
from sklearn.cluster import DBSCAN
from sklearn import metrics
from sklearn.preprocessing import StandardScaler
import seaborn as sns
from mpl_toolkits.mplot3d import Axes3D
import plotly.graph_objs as go
from plotly import tools
from plotly.subplots import make_subplots
import plotly.offline as py
from plotly.offline import download_plotlyjs, init_notebook_mode, plot, iplot
import cufflinks as cf
import warnings
warnings.filterwarnings("ignore")
from sklearn.cluster import KMeans
import missingno as msno
from sklearn.preprocessing import LabelEncoder
%matplotlib inline
from sklearn.cluster import KMeans
```

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```
[4] from sklearn.preprocessing import LabelEncoder
    %matplotlib inline
    from sklearn.cluster import KMeans
    from scipy.cluster.hierarchy import linkage, dendrogram
```

```
[5] path="/content/drive/MyDrive/Mall_Customers.csv"
    dataset=pd.read_csv(path)
```

```
dataset.head(3)
```

	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

```
[7] dataset.dtypes
```

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

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```
Annual Income (k$)      int64
Spending Score (1-100)  int64
dtype: object
```

```
dataset.rename(index=str, columns={'Annual Income (k$)': 'Income','Spending Score (1-100)': 'Score'}, inplace=True)
dataset.head(3)
```

	CustomerID	Gender	Age	Income	Score
0	1	Male	19	15	39
1	2	Male	21	15	81
2	3	Female	20	16	6

```
[9] dataset.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Index: 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   Income      200 non-null    int64
```

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```
 2   Age         200 non-null    int64
 3   Income      200 non-null    int64
 4   Score       200 non-null    int64
dtypes: int64(4), object(1)
memory usage: 9.4+ KB
```

```
print('This dataset contains ',dataset.shape[0],'rows')
print('This dataset contains ',dataset.shape[1],'columns')
```

```
This dataset contains  200 rows
This dataset contains  5 columns
```

```
dataset.iloc[:,1:].corr()
```

	Age	Income	Score
Age	1.000000	-0.012398	-0.327227
Income	-0.012398	1.000000	0.009903
Score	-0.327227	0.009903	1.000000

```
dataset.drop('CustomerID',axis=1,inplace=True)
print("Mean of Annual Income (k$) of Female:",dataset['Income'].loc[dataset['Gender'] == 'Female'].mean())
print("Mean of Annual Income (k$) of Male:",dataset['Income'].loc[dataset['Gender'] == 'Male'].mean())
```

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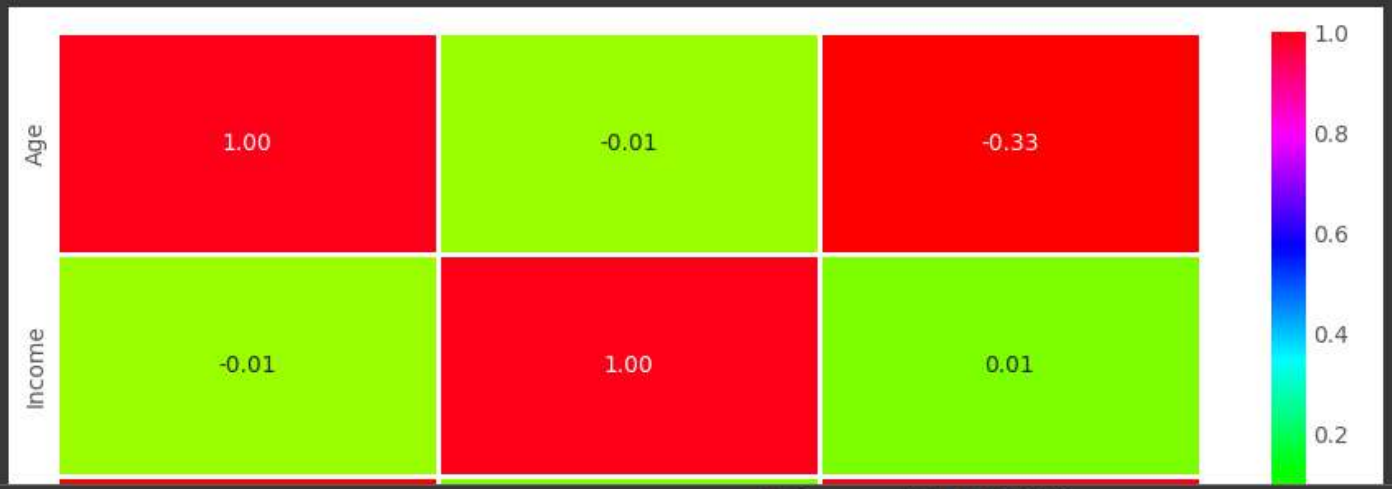
```
[12] print("Mean of Annual Income (k$) of Female:",dataset['Income'].loc[dataset['Gender'] == 'Female'].mean())
     print("Mean of Annual Income (k$) of Male:",dataset['Income'].loc[dataset['Gender'] == 'Male'].mean())
```

```
Mean of Annual Income (k$) of Female: 59.25
Mean of Annual Income (k$) of Male: 62.22727272727273
```

```
[13] plt.figure(figsize=(10,5))
     sns.heatmap(dataset.corr(),annot=True,cmap='hsv',fmt='.2f',linewidths=2)
     plt.show()
```



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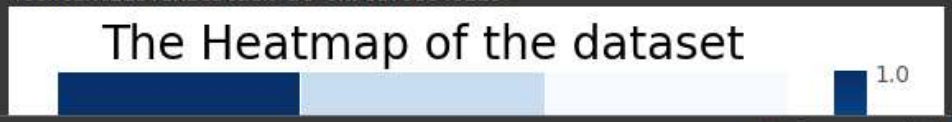
```
[14] hm=sns.heatmap(dataset.iloc[:,1:5].corr(), annot = True, linewidths=.5, cmap='Blues')
     hm.set_title(label='The Heatmap of the dataset', fontsize=20)
     hm
     plt.ioff()
```

```
<contextlib.ExitStack at 0x7caf68640220>
```



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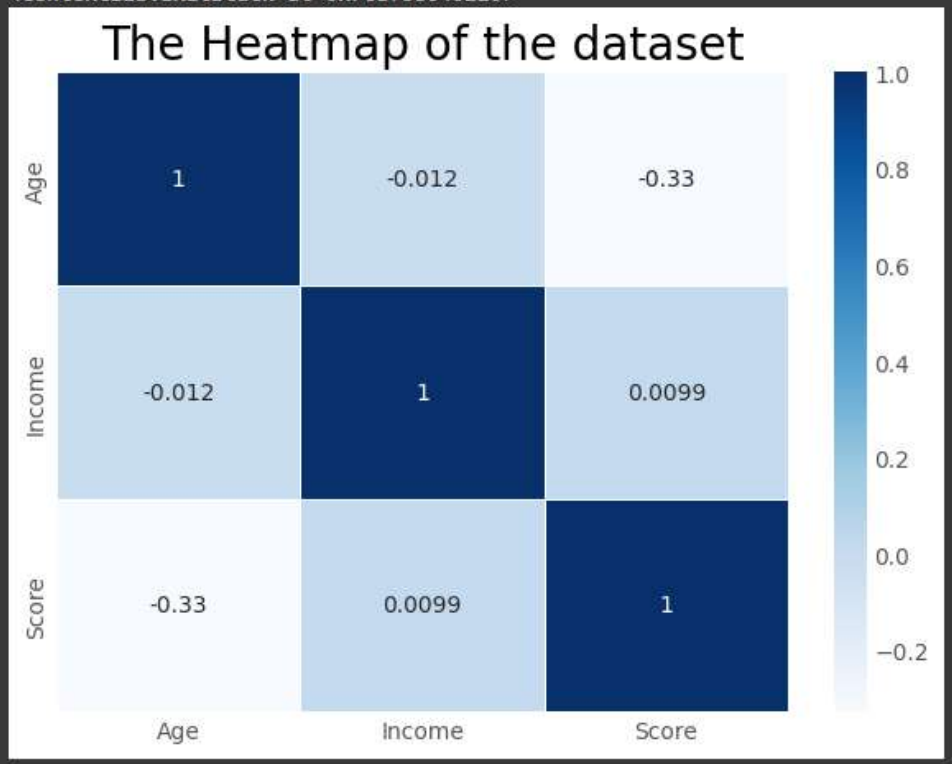
```
<contextlib.ExitStack at 0x7caf68640220>
```

0s



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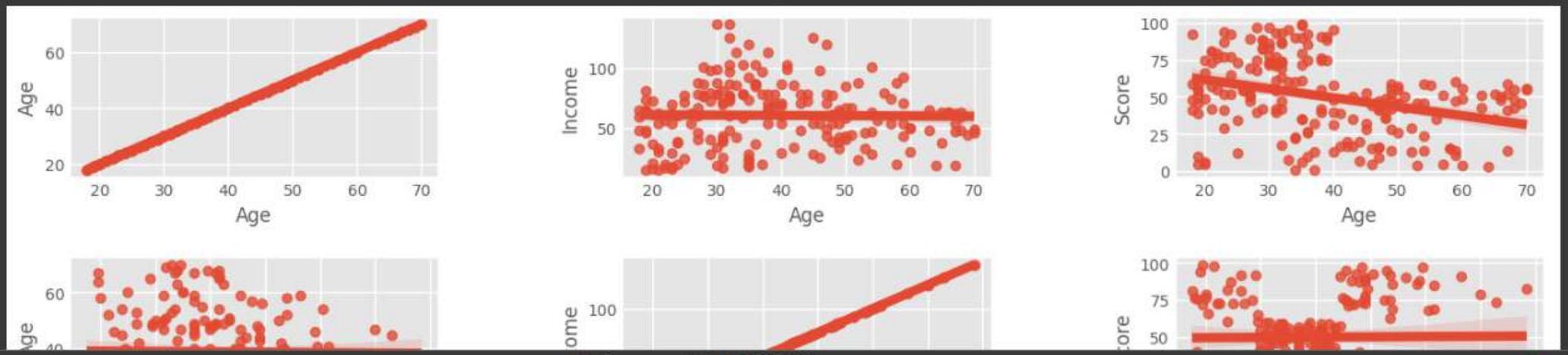
```
plt.figure(1,figsize=(15,7))
n=0
for x in ['Age','Income','Score']:
    for y in ['Age','Income','Score']:
        n+=1
        plt.subplot(3,3,n)
        plt.subplots_adjust(hspace=0.5,wspace=0.5)
        sns.regplot(x=x,y=y,data=dataset)
        plt.ylabel(y.split()[0]+''+y.split()[1] if len(y.split())>1 else y)
plt.show()
```



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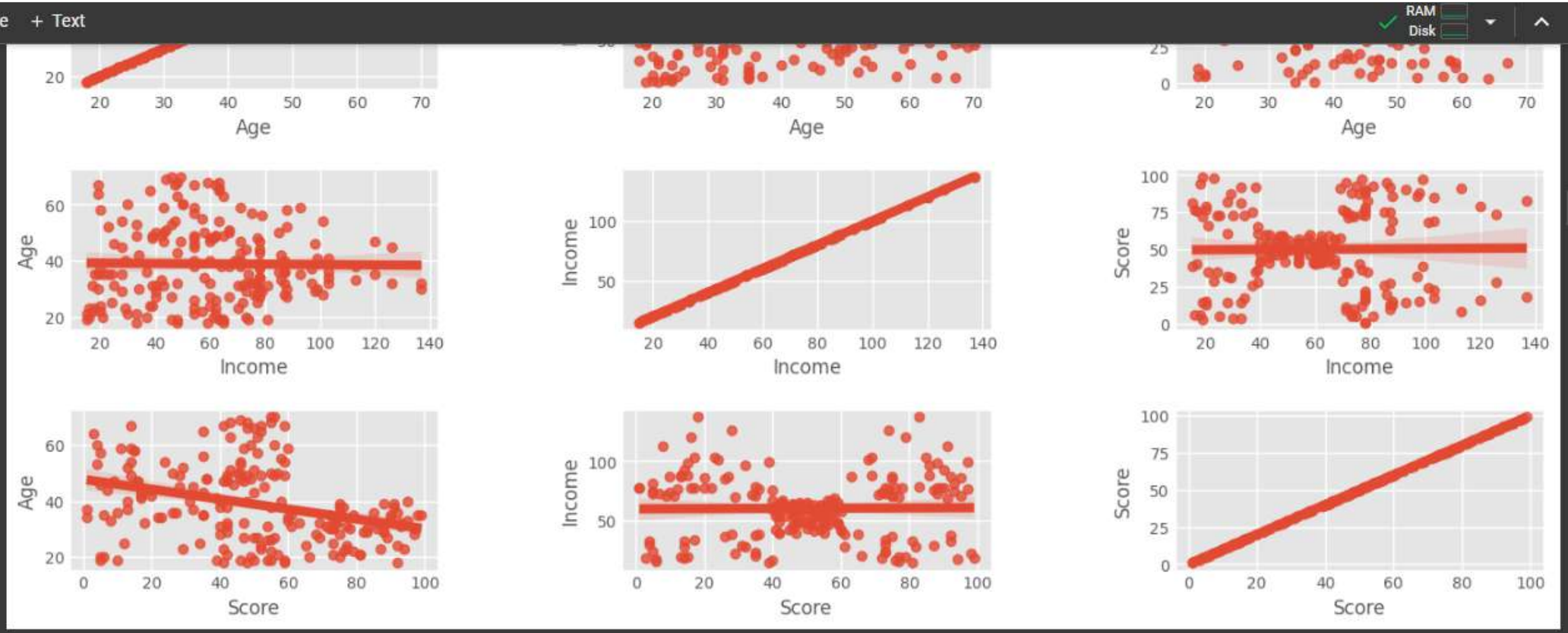
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Age
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Score
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```
dataset.groupby('Gender').mean()
```

Gender	Age	Income	Score
Female	38.098214	59.250000	51.526786
Male	39.806818	62.227273	48.511364

```
[17] print(sum(dataset.duplicated()))
     dataset = dataset.drop_duplicates()
```

```
0
```

```
[18] dataset.Age.unique()
```

```
array([19, 21, 20, 23, 31, 22, 35, 64, 30, 67, 58, 24, 37, 52, 25, 46, 54,
       29, 45, 40, 60, 53, 18, 49, 42, 36, 65, 48, 50, 27, 33, 59, 47, 51,
       69, 70, 63, 43, 68, 32, 26, 57, 38, 55, 34, 66, 39, 44, 28, 56, 41])
```

```
[20] print(len(dataset.Age.unique()))
```

```
51
```

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```
51
```

```
dataset.Age.value_counts()[:10]
```

```
32    11
35     9
19     8
31     8
30     7
49     7
40     6
38     6
47     6
27     6
Name: Age, dtype: int64
```

```
[21] dataset['Age'].describe()
```

```
count    200.000000
mean      38.850000
std       13.969007
min       18.000000
25%       28.750000
50%       36.000000
75%       49.000000
max       70.000000
Name: Age, dtype: float64
```

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[21] `dataset['Age'].describe()`

```
count    200.000000
mean      38.850000
std       13.969007
min       18.000000
25%       28.750000
50%       36.000000
75%       49.000000
max       70.000000
Name: Age, dtype: float64
```

```
bins = [18, 22, 50, 70]
labels = ['Young', 'Adult', 'Senior']
dataset['Age Range'] = pd.cut(dataset['Age'], bins=bins, labels=labels, right=False)
dataset.head()
```

	Gender	Age	Income	Score	Age Range
0	Male	19	15	39	Young
1	Male	21	15	81	Young
2	Female	20	16	6	Young
3	Female	23	16	77	Adult

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```
bins = [18, 22, 50, 70]
labels = ['Young', 'Adult', 'Senior']
dataset['Age Range'] = pd.cut(dataset['Age'], bins=bins, labels=labels, right=False)
dataset.head()
```

	Gender	Age	Income	Score	Age Range
0	Male	19	15	39	Young
1	Male	21	15	81	Young
2	Female	20	16	6	Young
3	Female	23	16	77	Adult
4	Female	31	17	40	Adult

```
[26] dataset.Age.value_counts()[:3]
```

```
32    11
35     9
19     8
Name: Age, dtype: int64
```

```
[27] AnnualIncome_32=0
     AnnualIncome_35=0
```

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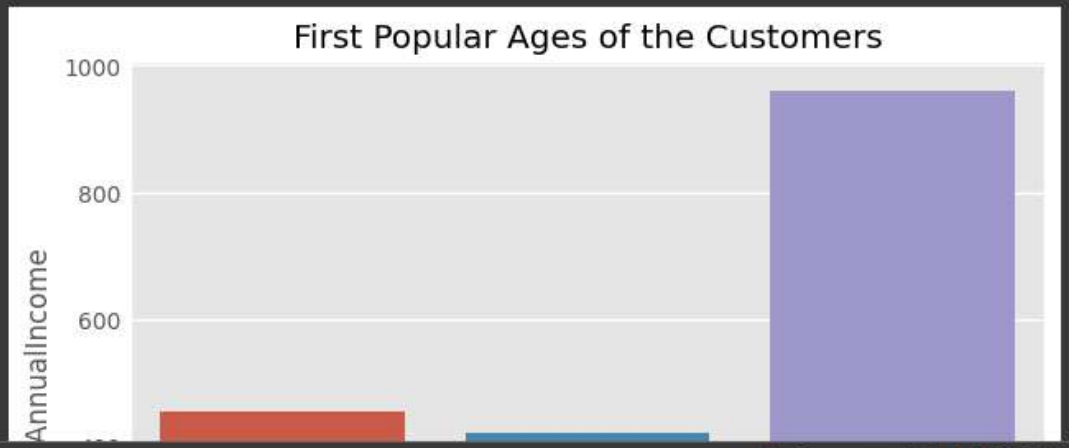
```
AnnualIncome_32=0
AnnualIncome_35=0
AnnualIncome_19=0
AnnualIncome_32=sum(dataset[dataset['Age']==32].Income)
AnnualIncome_35=sum(dataset[dataset['Age']==35].Income)
AnnualIncome_19=sum(dataset[dataset['Age']==19].Income)
plt.title('First Popular Ages of the Customers')
sns.barplot(x=['19','35','32'],y=[AnnualIncome_19,AnnualIncome_35,AnnualIncome_32])
plt.xlabel('Ages')
plt.ylabel('Total AnnualIncome')
plt.show()
```



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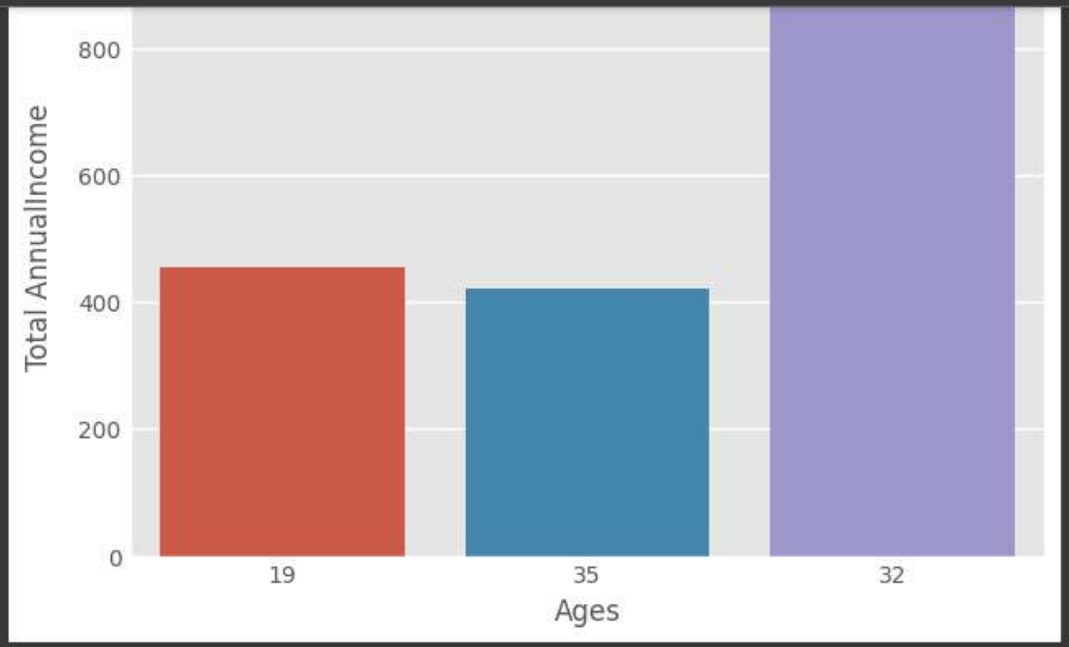


```
[28] dataset.Gender.unique()
```

```
array(['Male', 'Female'], dtype=object)
```

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```
[28] dataset.Gender.unique()
```

```
array(['Male', 'Female'], dtype=object)
```

```
dataset.Gender.value_counts()
```

```
Female    112
Male       88
Name: Gender, dtype: int64
```

```
[31] labels=dataset.Gender.unique()
colors=['lightgreen','red']
explode=[0,0.1]
values=dataset.Gender.value_counts().values
plt.figure(figsize=(7,7))
plt.pie(values,explode=explode,labels=labels,colors=colors,autopct='%1.1f%%')
plt.title('Race/Ethnicity According Analysis',color='black',fontsize=10)
plt.show()
```

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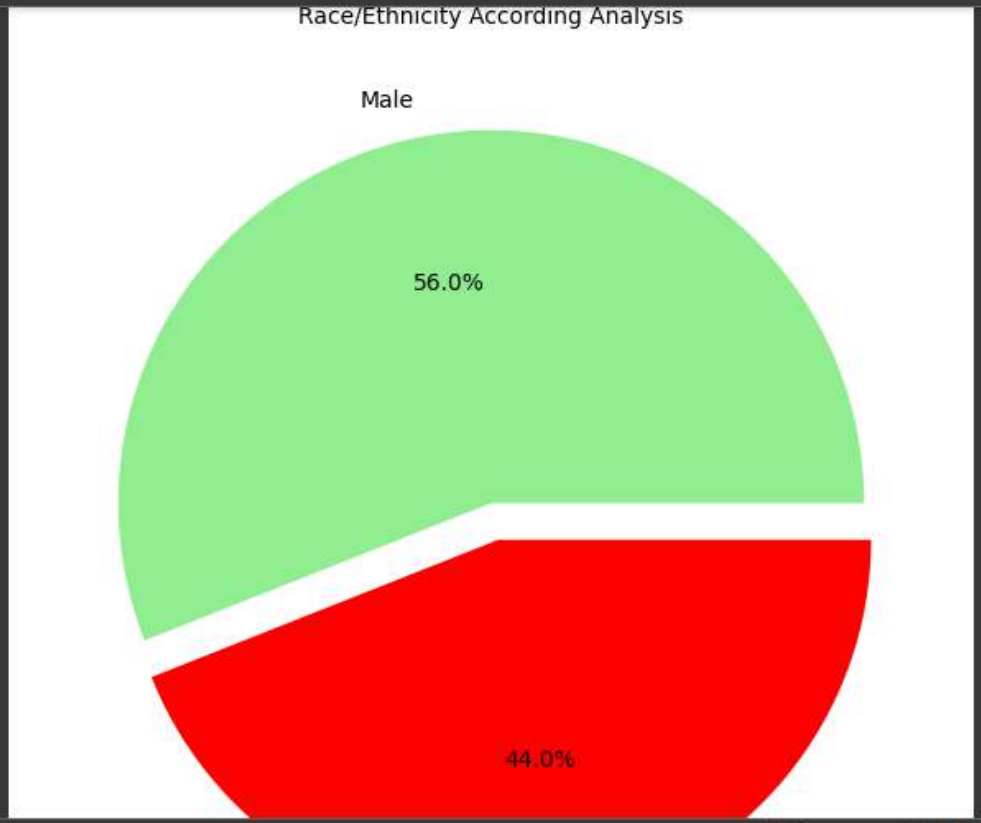
[31]



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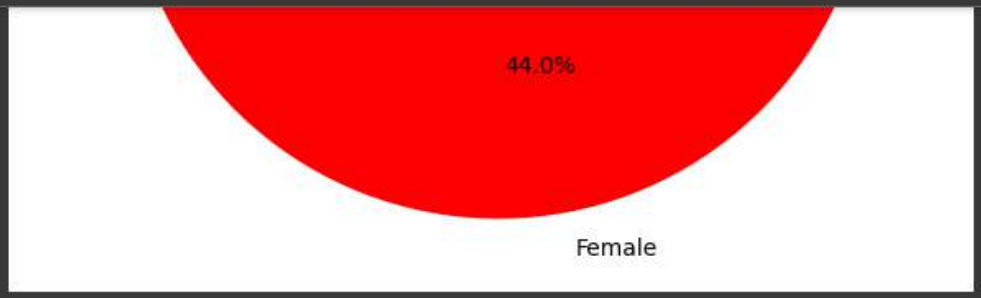
[31]



[32]
```
#Male Age
print('Max  :',max(dataset[dataset['Gender']=='Male'].Age))
print('Min  :',min(dataset[dataset['Gender']=='Male'].Age))
print('Mean :',np.mean(dataset[dataset['Gender']=='Male'].Age))
print('Std  :',np.std(dataset[dataset['Gender']=='Male'].Age))
```

```
Max  : 70
Min  : 18
Mean : 39.80681818181818
Std  : 15.426407372472944
```

[33]
```
#Female Age
print('Max  :',max(dataset[dataset['Gender']=='Female'].Age))
print('Min  :',min(dataset[dataset['Gender']=='Female'].Age))
print('Mean :',np.mean(dataset[dataset['Gender']=='Female'].Age))
```

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[32]
```
Max  : 70
Min  : 18
Mean : 39.80681818181818
Std  : 15.426407372472944
```

```
#Female Age
print('Max  :',max(dataset[dataset['Gender']=='Female'].Age))
print('Min  :',min(dataset[dataset['Gender']=='Female'].Age))
print('Mean :',np.mean(dataset[dataset['Gender']=='Female'].Age))
print('Std  :',np.std(dataset[dataset['Gender']=='Female'].Age))
```

```
Max  : 68
Min  : 18
Mean : 38.098214285714285
Std  : 12.587522039581055
```

[34]
```
print('Max  :',max(dataset[dataset['Gender']=='Male'].Income))
print('Min  :',min(dataset[dataset['Gender']=='Male'].Income))
print('Mean :',np.mean(dataset[dataset['Gender']=='Male'].Income))
print('Std  :',np.std(dataset[dataset['Gender']=='Male'].Income))
```

```
Max  : 137
Min  : 15
Mean : 62.22727272727273
Std  : 26.486586344758496
```

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```
[34] print('Max  :',max(dataset[dataset['Gender']=='Male'].Income))
     print('Min  :',min(dataset[dataset['Gender']=='Male'].Income))
     print('Mean :',np.mean(dataset[dataset['Gender']=='Male'].Income))
     print('Std  :',np.std(dataset[dataset['Gender']=='Male'].Income))
```

```
Max  : 137
Min  : 15
Mean : 62.22727272727273
Std  : 26.486586344758496
```

```
[35] print('Max  :',max(dataset[dataset['Gender']=='Female'].Income))
     print('Min  :',min(dataset[dataset['Gender']=='Female'].Income))
     print('Mean :',np.mean(dataset[dataset['Gender']=='Female'].Income))
     print('Std  :',np.std(dataset[dataset['Gender']=='Female'].Income))
```

```
Max  : 126
Min  : 16
Mean : 59.25
Std  : 25.8955663607278
```

```
[36] #Male SpendingScore
     print('Max  :',max(dataset[dataset['Gender']=='Male'].Score))
     print('Min  :',min(dataset[dataset['Gender']=='Male'].Score))
     print('Mean :',np.mean(dataset[dataset['Gender']=='Male'].Score))
     print('Std  :',np.std(dataset[dataset['Gender']=='Male'].Score))
```

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```
Mean : 59.25
Std  : 25.8955663607278
```

```
[36] #Male SpendingScore
print('Max  :',max(dataset[dataset['Gender']=='Male'].Score))
print('Min  :',min(dataset[dataset['Gender']=='Male'].Score))
print('Mean :',np.mean(dataset[dataset['Gender']=='Male'].Score))
print('Std  :',np.std(dataset[dataset['Gender']=='Male'].Score))
```

```
Max  : 97
Min  : 1
Mean : 48.51136363636363
Std  : 27.737812359739767
```

```
[37] #Female SpendingScore
print('Max  :',max(dataset[dataset['Gender']=='Female'].Score))
print('Min  :',min(dataset[dataset['Gender']=='Female'].Score))
print('Mean :',np.mean(dataset[dataset['Gender']=='Female'].Score))
print('Std  :',np.std(dataset[dataset['Gender']=='Female'].Score))
```

```
Max  : 99
Min  : 5
Mean : 51.526785714285715
Std  : 24.00705246880166
```

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[38]
```
from sklearn.preprocessing import LabelEncoder
label_encoder = LabelEncoder()
integer_encoded = label_encoder.fit_transform(dataset['Gender'].values)
dataset['Gender'] = integer_encoded
dataset.head(7)
```

	Gender	Age	Income	Score	Age Range
0	1	19	15	39	Young
1	1	21	15	81	Young
2	0	20	16	6	Young
3	0	23	16	77	Adult
4	0	31	17	40	Adult
5	0	22	17	76	Adult
6	0	35	18	6	Adult

[39]
```
sns.set(style='white', palette='muted', color_codes=True)
fig, axs = plt.subplots(1, 3, figsize=(12, 3))
sns.despine(left=True)
axs[0] = sns.distplot(dataset['Age'], bins=20, ax=axs[0])
```

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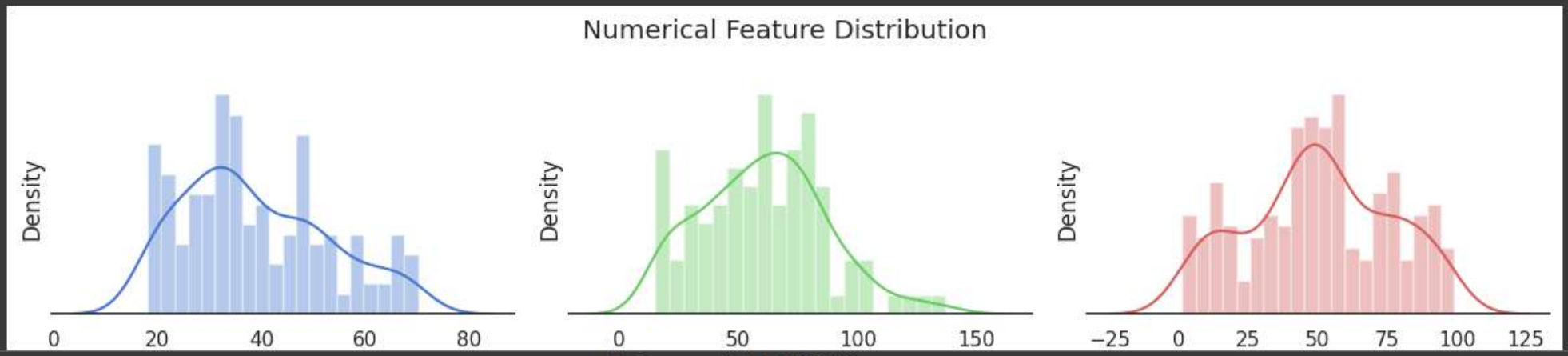
```
[39] sns.set(style='white', palette='muted', color_codes=True)
     fig, axs = plt.subplots(1, 3, figsize=(12, 3))
     sns.despine(left=True)
     axs[0] = sns.distplot(dataset['Age'], bins=20, ax=axs[0])
     axs[1] = sns.distplot(dataset['Income'], bins=20, ax=axs[1], color='g')
     axs[2] = sns.distplot(dataset['Score'], bins=20, ax=axs[2], color='r')
     fig.suptitle('Numerical Feature Distribution')
     plt.setp(axs, yticks=[])
     plt.tight_layout()
     plt.show()
```

3s



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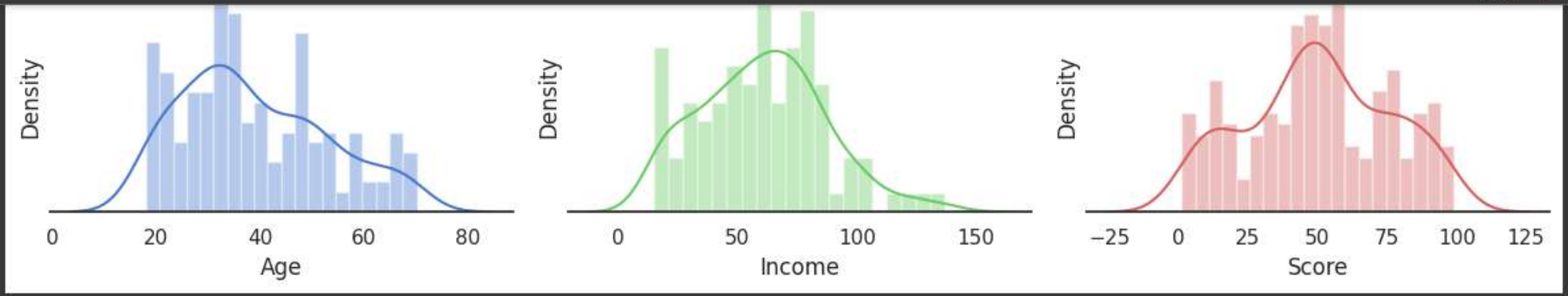
[39]



[42]
```
plt.figure(figsize=(8,6))
sns.distplot(dataset['Income'],bins=5,color='brown')
```

```
<Axes: xlabel='Income', ylabel='Density'>
```

[45]
```
x = dataset['Income']
y = dataset['Age']
z = dataset['Score']

sns.lineplot(x, color = 'blue')
sns.lineplot(y,color='blue')
sns.lineplot(x, color = 'red')
```

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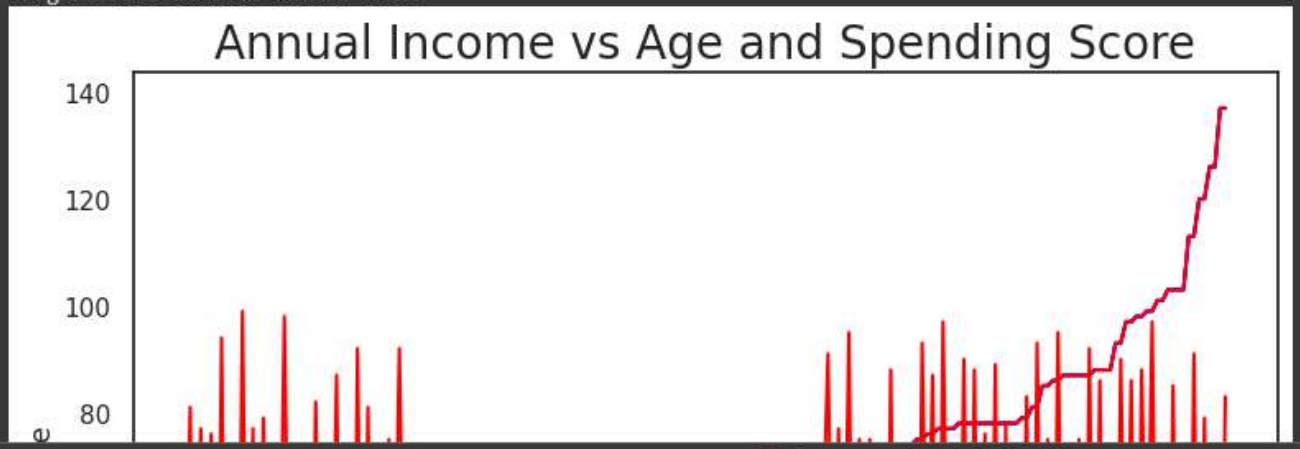
```
x = dataset['Income']
y = dataset['Age']
z = dataset['Score']

sns.lineplot(x, color = 'blue')
sns.lineplot(y,color='blue')
sns.lineplot(x, color = 'red')
sns.lineplot(z,color='red')
plt.title('Annual Income vs Age and Spending Score', fontsize = 20)
plt.show()
```

2s

```
<Figure size 800x600 with 0 Axes>
```



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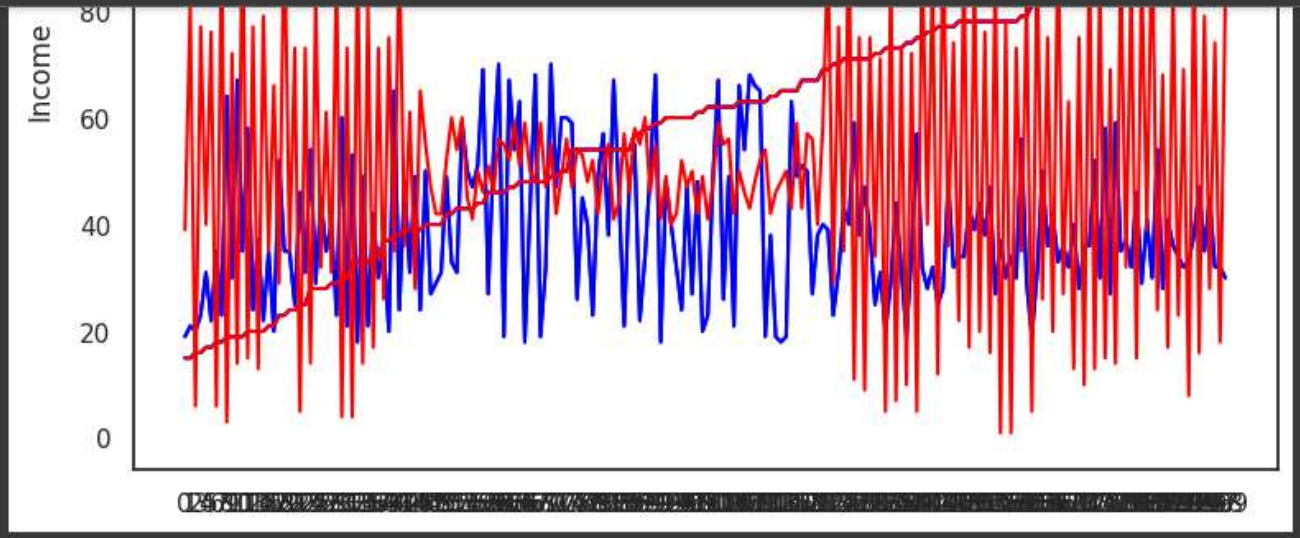
[45]




```
[46] sns.pairplot(dataset[['Age','Income','Score']])
     plt.show()
```

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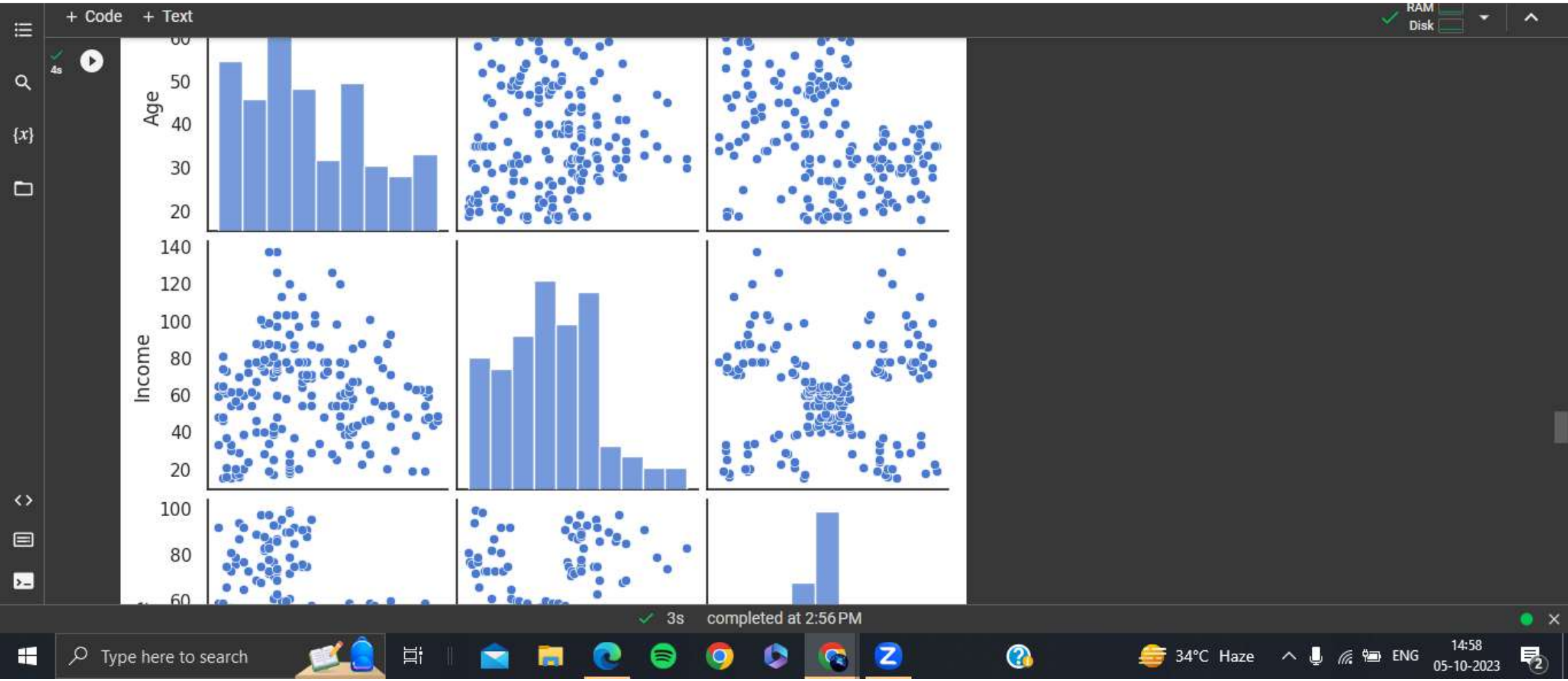
+ Code
+ Text
RAM
Disk
4s
Age
50
40
30
20
Income
140
120
100
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3s
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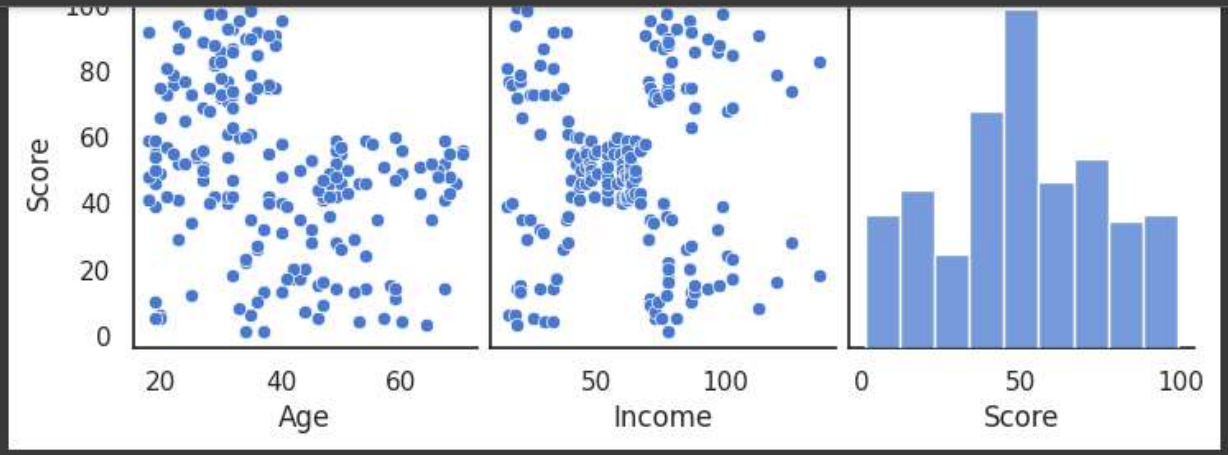
34°C Haze
ENG
14:58
05-10-2023




```
plt.figure(figsize=(25,5))
plt.subplot(1,3,1)
for gender in ['Male' , 'Female']:
    plt.scatter(x = 'Age' , y = 'Income' , data = dataset[dataset['Gender'] == gender] ,label = gender,s=100)
    plt.title('Age vs Annual Income ')
plt.subplot(1,3,2)
for gender in ['Male' , 'Female']:
    plt.scatter(x = 'Income',y = 'Score' ,data = dataset[dataset['Gender'] == gender] ,s = 100 , label = gender)
    plt.title('Annual Income vs Spending')
plt.legend()
```

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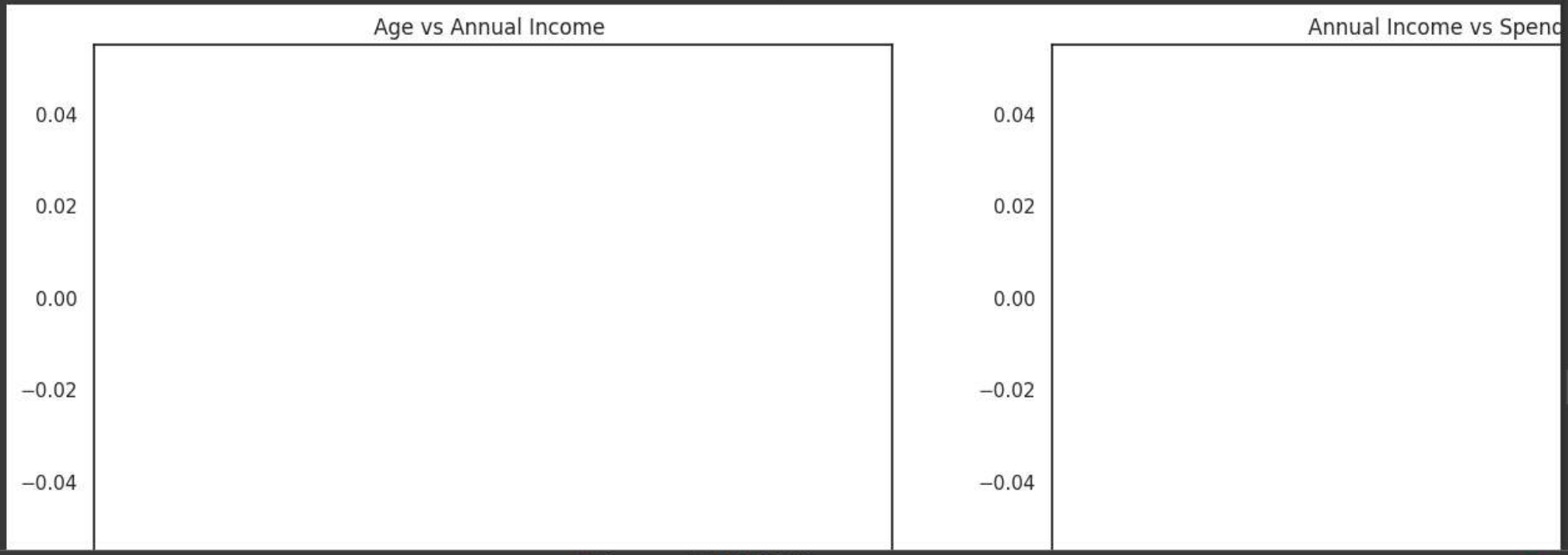
+ Code + Text

RAM
Disk

```
plt.legend()
plt.show()
```



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+ Code + Text

RAM
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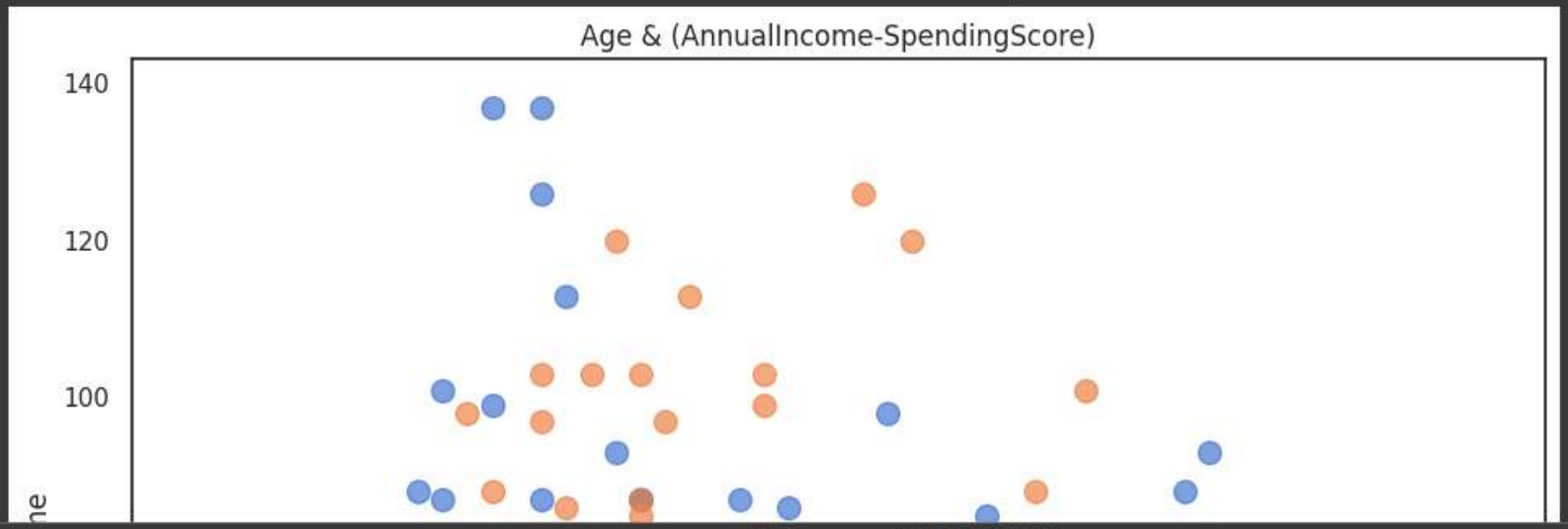
```
plt.figure(figsize=(10,8))
for gender in dataset.Gender.unique():
    plt.scatter(x='Age',y='Income',data=dataset[dataset['Gender']==gender],s=100,alpha=.7)
    plt.xlabel('Age')
    plt.ylabel('AnnualIncome')
    plt.title('Age & (AnnualIncome-SpendingScore)')
plt.show()
```



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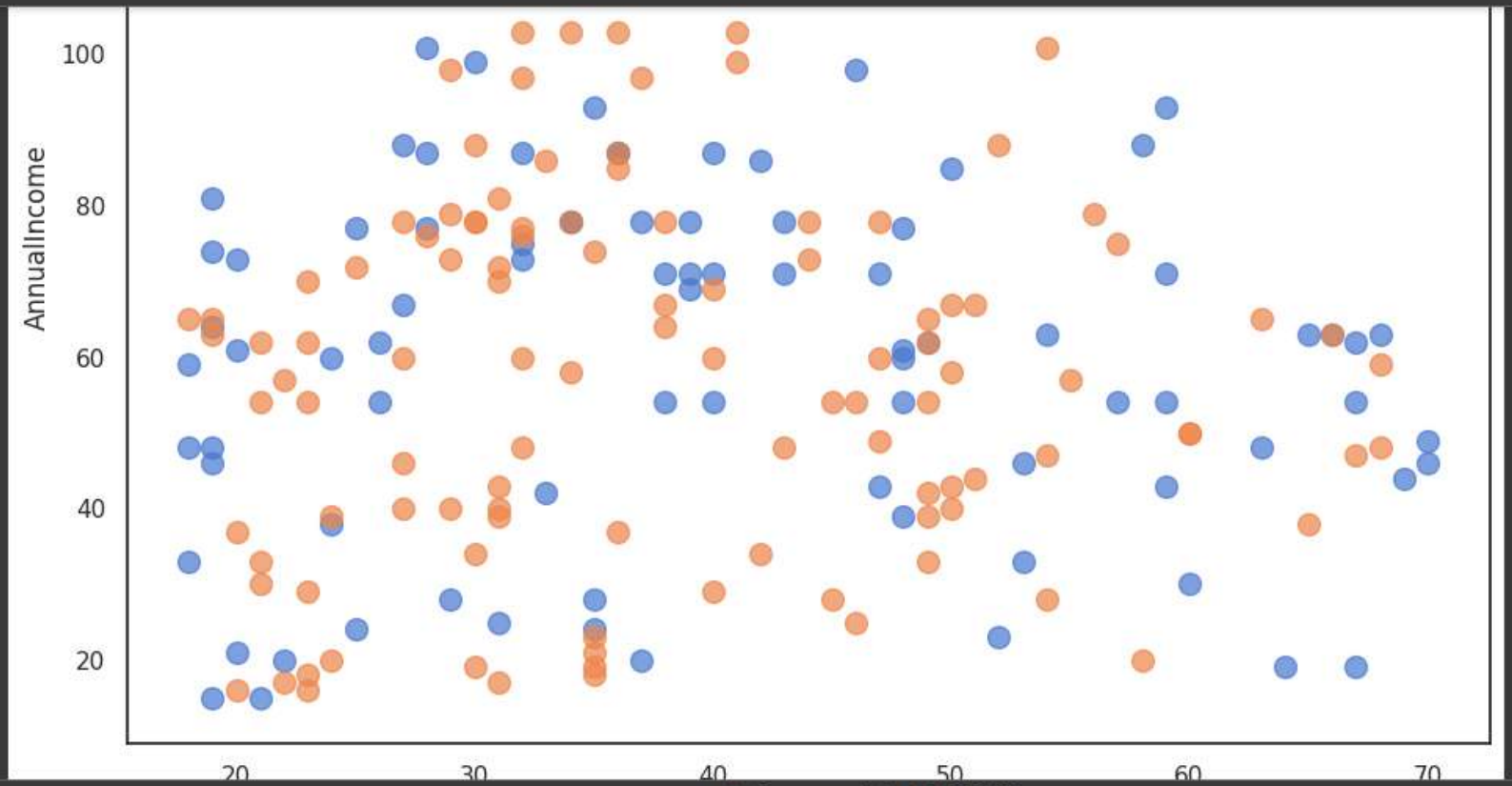
+ Code + Text

RAM
Disk

[50]
1s



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ENG

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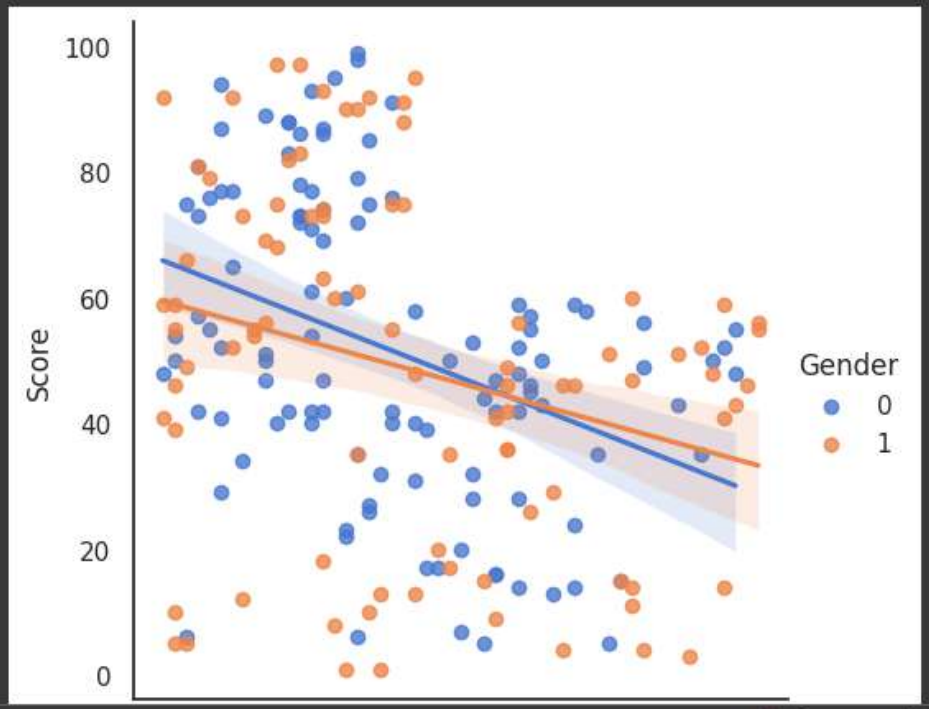
05-10-2023

+ Code + Text

RAM
Disk

```
sns.lmplot(x='Age', y='Score', data=dataset,fit_reg=True,hue='Gender')
plt.show()
```



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ENG

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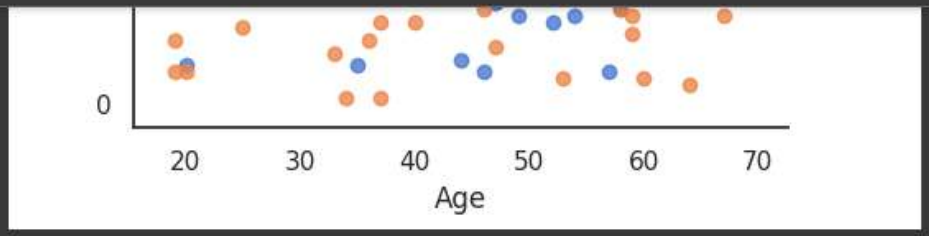
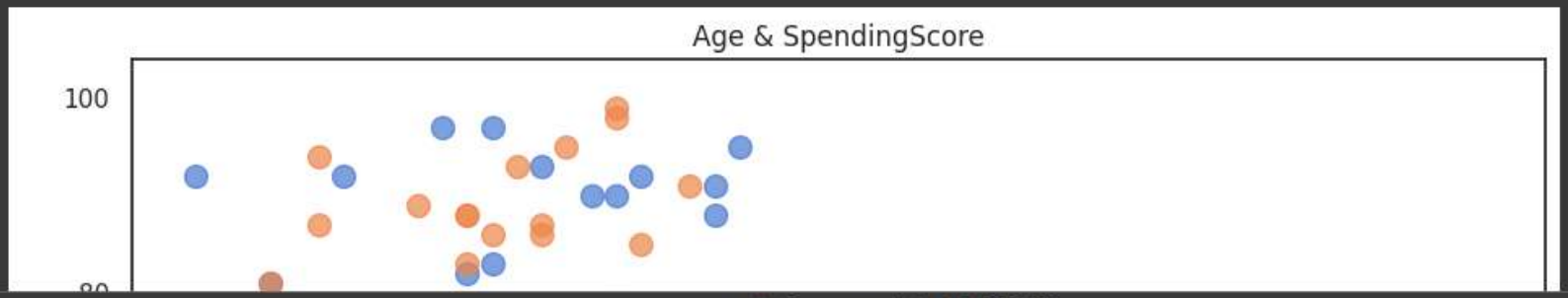



```
[52] plt.figure(figsize=(10,8))
     for gender in dataset.Gender.unique():
         plt.scatter(x='Age',y='Score',data=dataset[dataset['Gender']==gender],s=100,alpha=.7)
         plt.xlabel('Age')
         plt.ylabel('SpendingScore')
         plt.title('Age & SpendingScore')
     plt.show()
```



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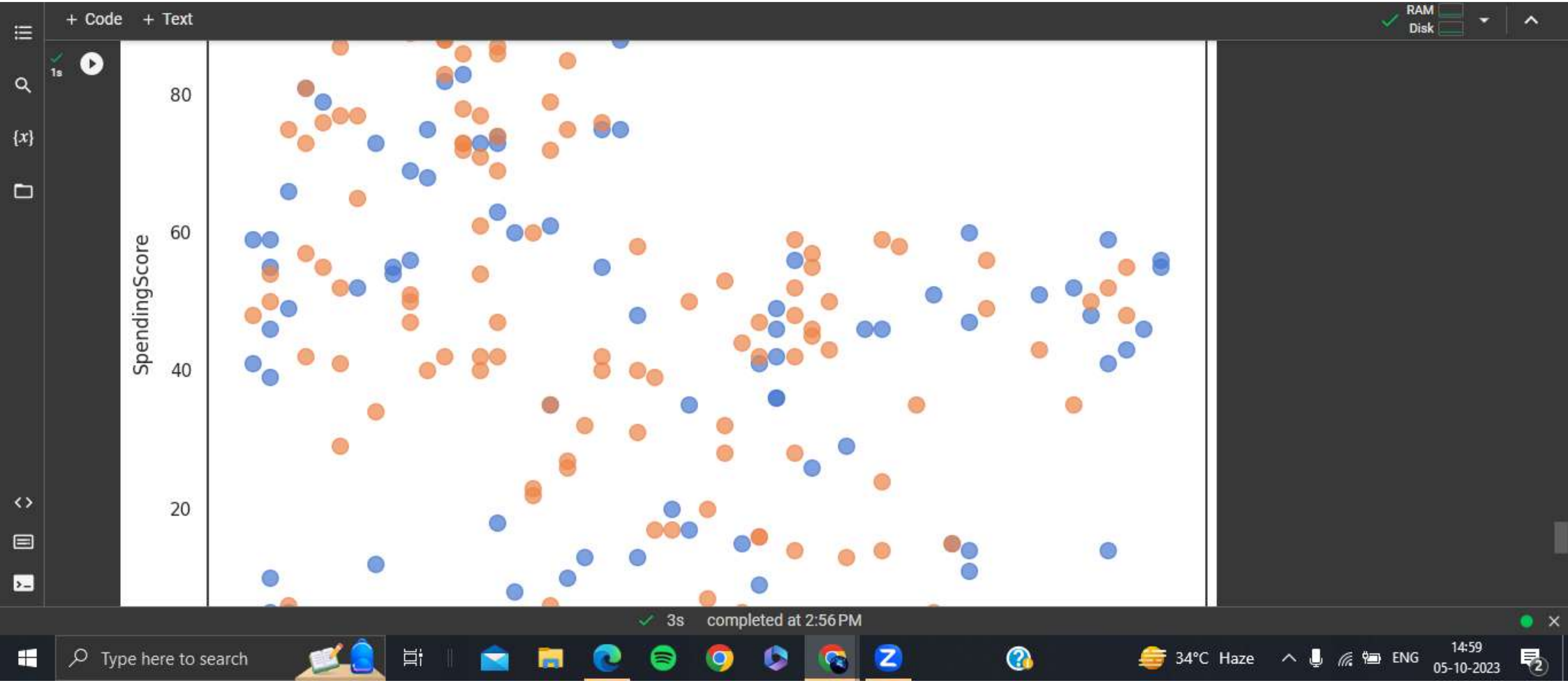
+ Code
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RAM
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34°C Haze
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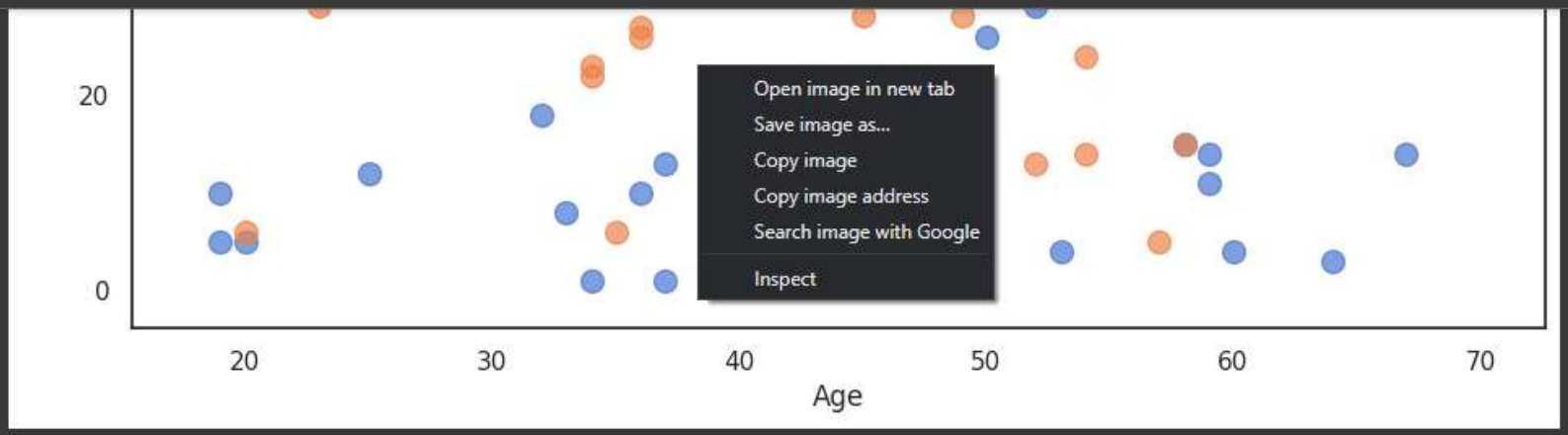
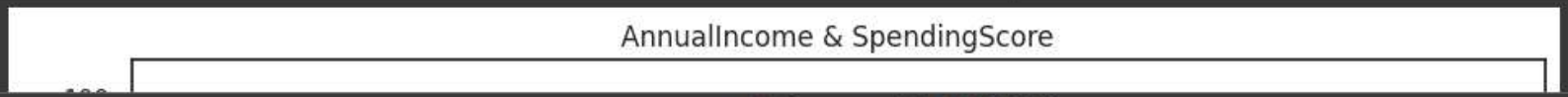
05-10-2023




```
[53] plt.figure(figsize=(10,8))
     for gender in dataset.Gender.unique():
         plt.scatter(x='Income',y='Score',data=dataset[dataset['Gender']==gender],s=100,alpha=.7)
         plt.xlabel('AnnualIncome')
         plt.ylabel('SpendingScore')
         plt.title('AnnualIncome & SpendingScore')
     plt.show()
```



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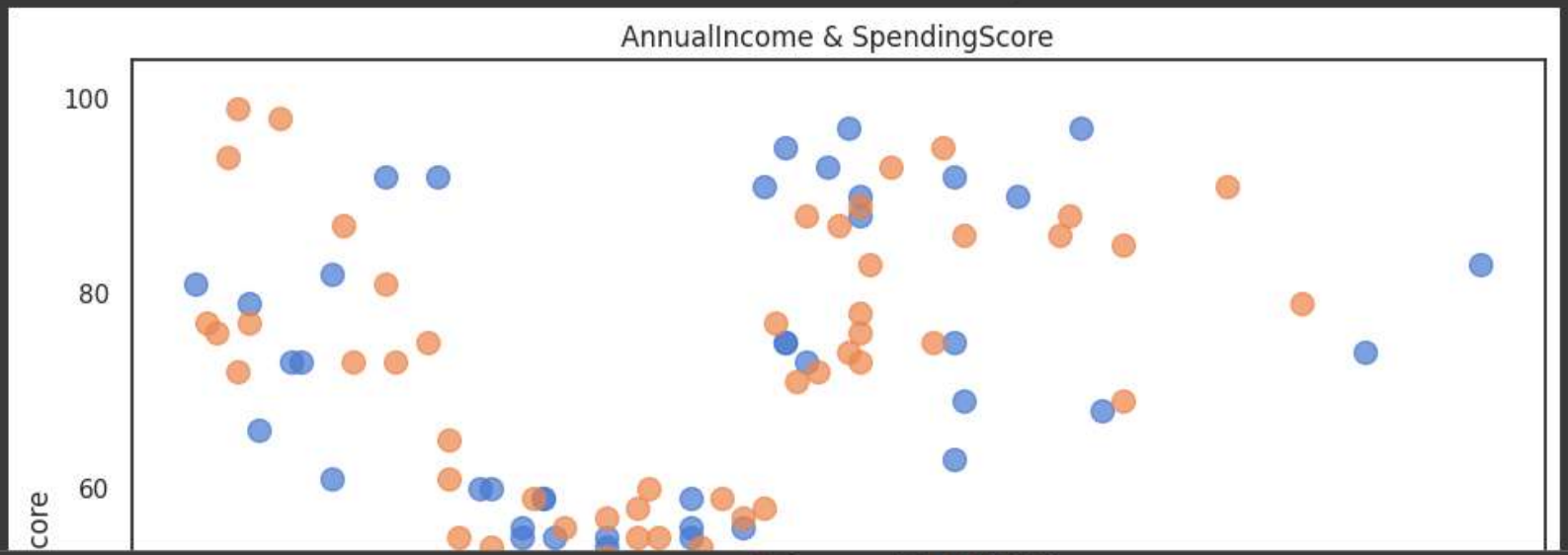
```
plt.figure(figsize=(10,8))
for gender in dataset.Gender.unique():
    plt.scatter(x='Income',y='Score',data=dataset[dataset['Gender']==gender],s=100,alpha=.7)
    plt.xlabel('AnnualIncome')
    plt.ylabel('SpendingScore')
    plt.title('AnnualIncome & SpendingScore')
plt.show()
```



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Closed road on Bhair...

ENG

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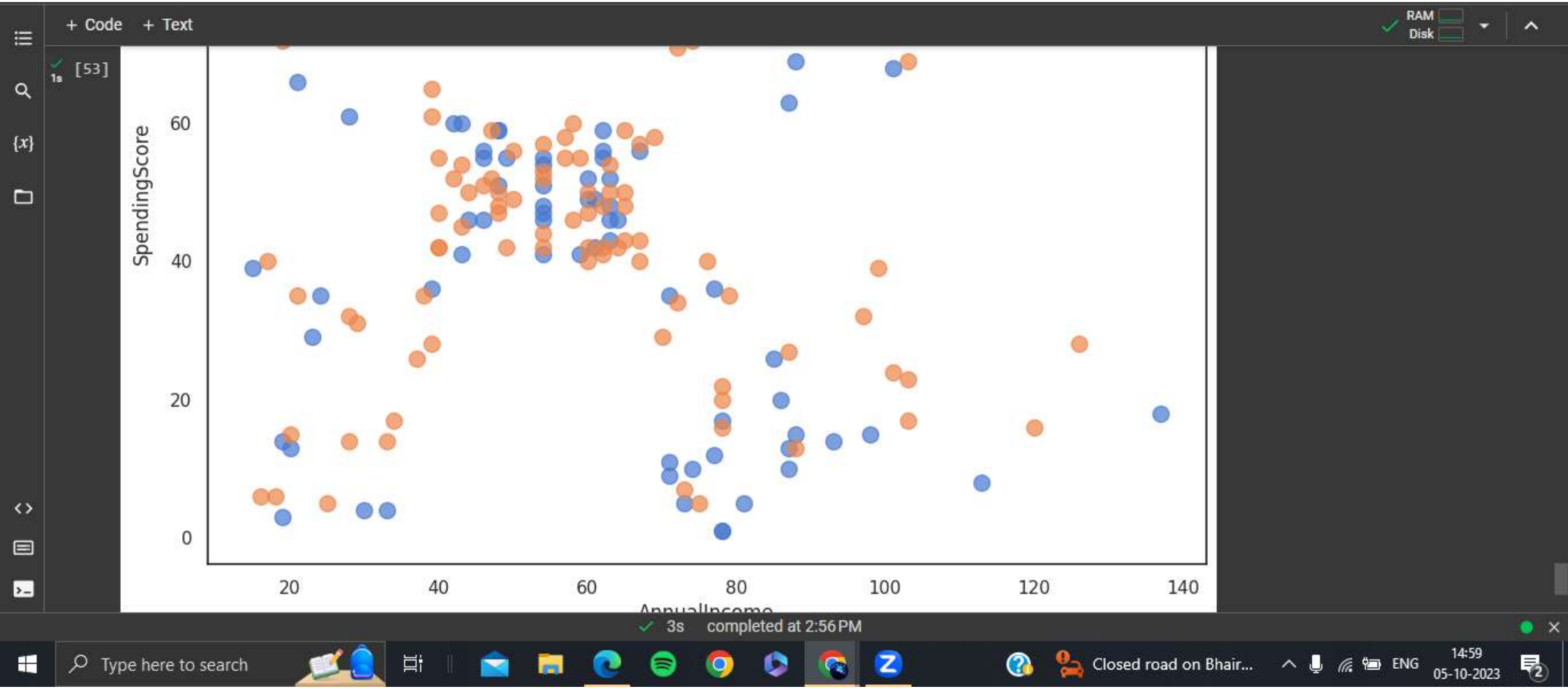
+ Code
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RAM
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[53]
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SpendingScore
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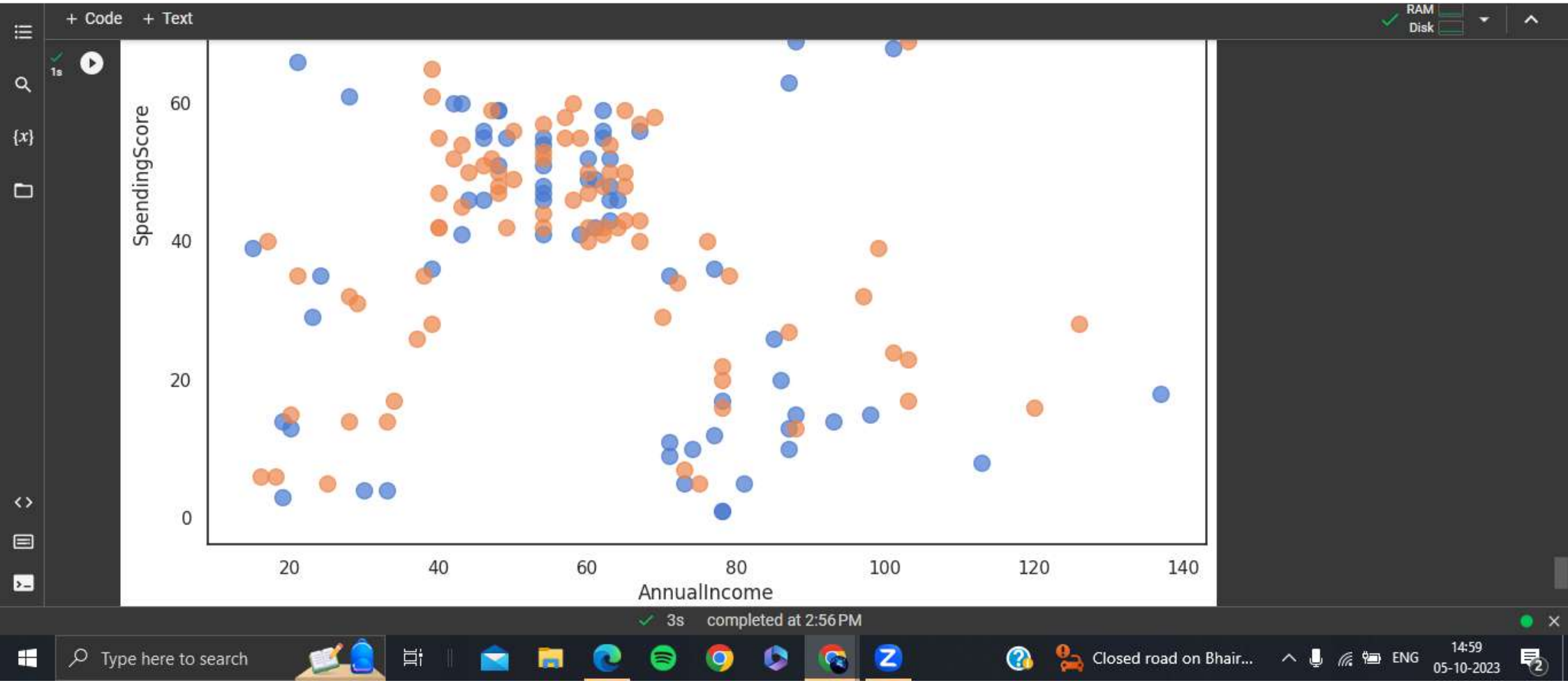
Closed road on Bhair...
ENG
14:59
05-10-2023


+ Code
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RAM
Disk
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SpendingScore
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120
140
AnnualIncome
3s
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Closed road on Bhair...
ENG
14:59
05-10-2023