Assignment -4

Assignment Date	18 October 2022
Student Name	Dinesh Kumar S
Student Roll Number	811519104026
Maximum Marks	2 Marks

```
[1]: import pandas as pd
     from matplotlib import pyplot as plt
     %matplotlib inline
     import seaborn as sns
     from sklearn.experimental import enable_iterative_imputer
     from sklearn.impute import IterativeImputer
     import pickle
     import numpy as np
     from sklearn.preprocessing import StandardScaler
```

```
[2]: df=pd.read_csv(r"C:\Users\Admin\Downloads\Mall_Customers.csv")
```

```
[3]: df.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
3	4	Female	23	16	77
4	5	Female	31	17	40

```
[4]: df.shape
```

[4]: (200, 5)

Checking the Null Values

```
[5]: df.isnull().sum()
```

[5]:
```
CustomerID              0
Gender                  0
Age                     0
Annual Income (k$)      0
Spending Score (1-100)  0
dtype: int64
```
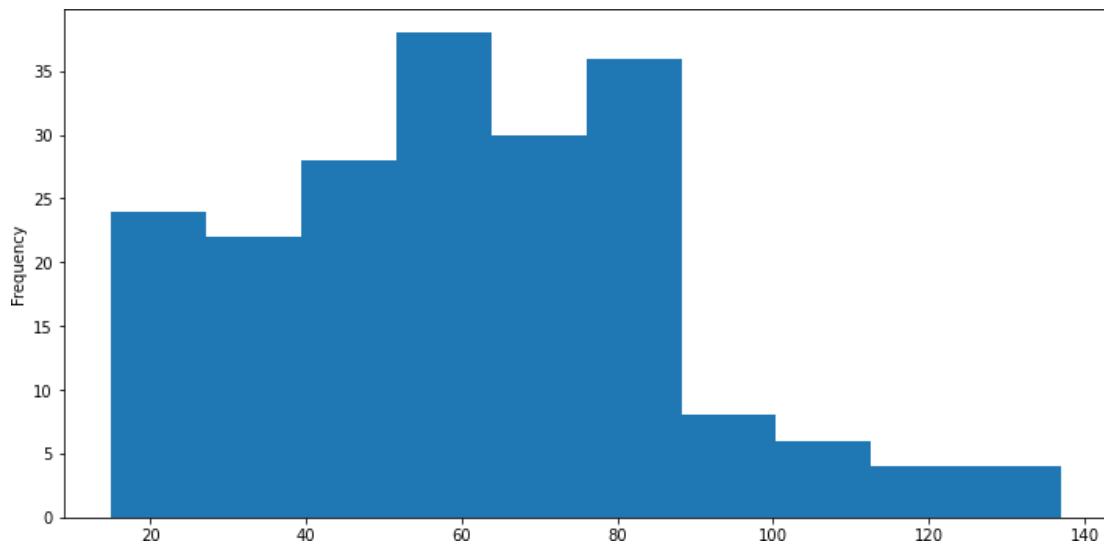
Renaming The Columns

```
[6]:  df.columns=["CustomerID","Gender","Age","Annual_Income","Spending_Score"]
```
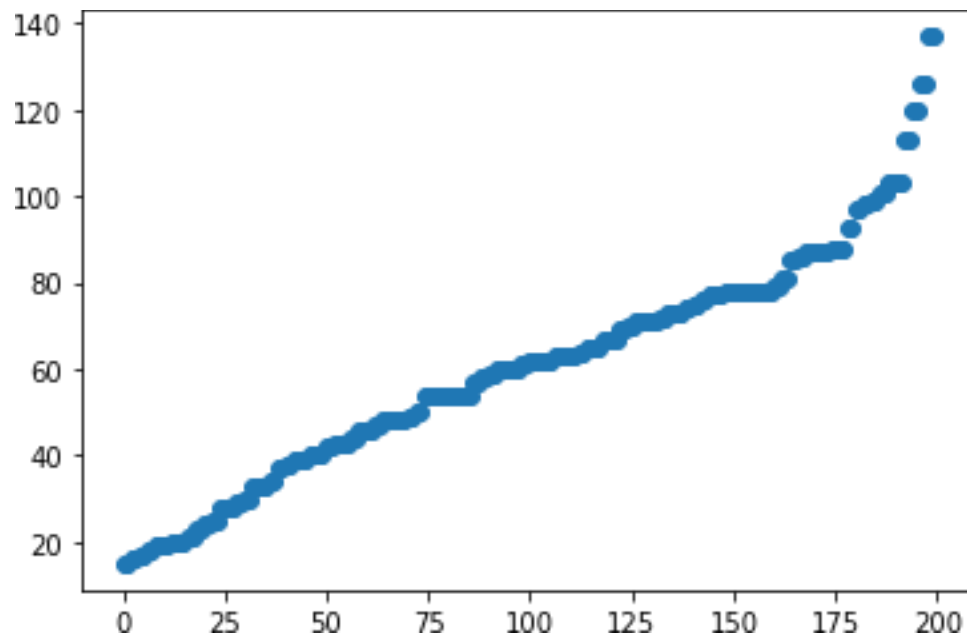
Univariant Plot

```
[7]:  plt.figure()
      df.Annual_Income.plot(kind="hist" ,figsize=(12,6))
```

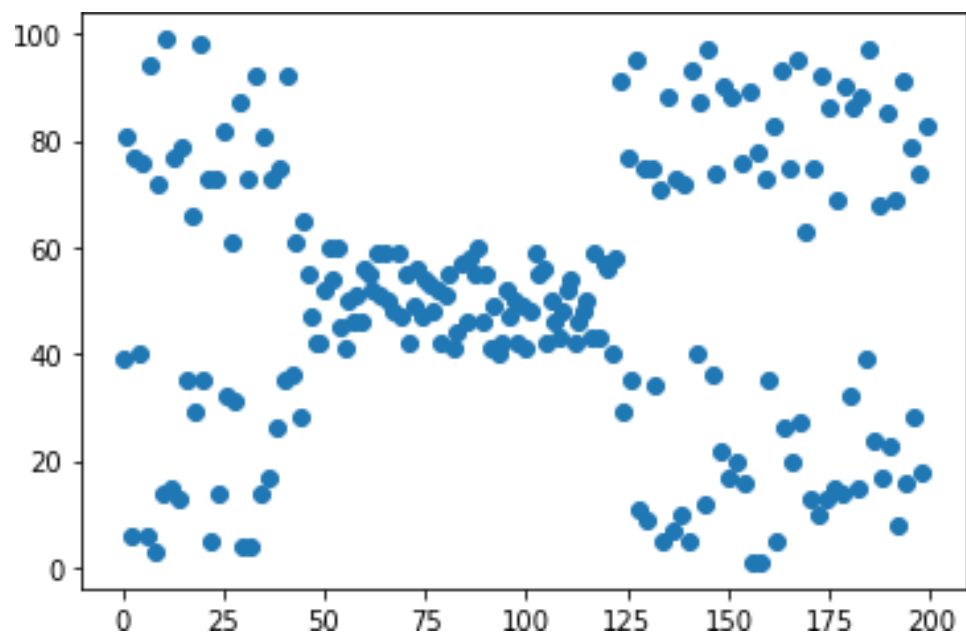[7] : <AxesSubplot:ylabel='Frequency'>


```
[8]:  plt.scatter(df.index,df["Annual_Income"])
```

[8] : <matplotlib.collections.PathCollection at 0x15b1393a340>

[9]: `plt.scatter(df.index,df["Spending_Score"])`

[9] : <matplotlib.collections.PathCollection at 0x15b139bb7f0>

```
[10]:  # z score computation
       outliers=[]
       def detect_outliers(data):
               threshold=3
               mean=np.mean(data)
               std=np.std(data)

               for i in data:
                   z_score=(i-mean)/std
                   if np.abs(z_score)>threshold:
                       outliers.append(i)

               return outliers
```
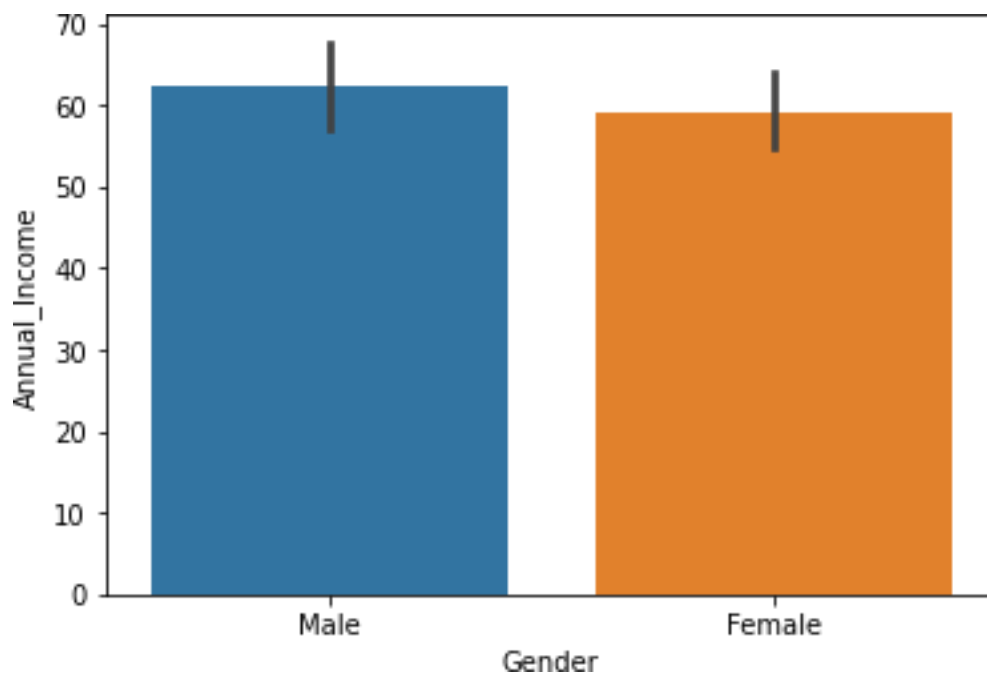
Bivariant Plot

```
[11]:  sns.barplot(x="Gender",y="Annual_Income",data=df)
```

[11] : <AxesSubplot:xlabel='Gender', ylabel='Annual_Income'>


```
[12]:  df
```

[12] :

	CustomerID	Gender	Age	Annual_Income	Spending_Score
0	1	Male	19	15	39
1	2	Male	21	15	81

4

```
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
```
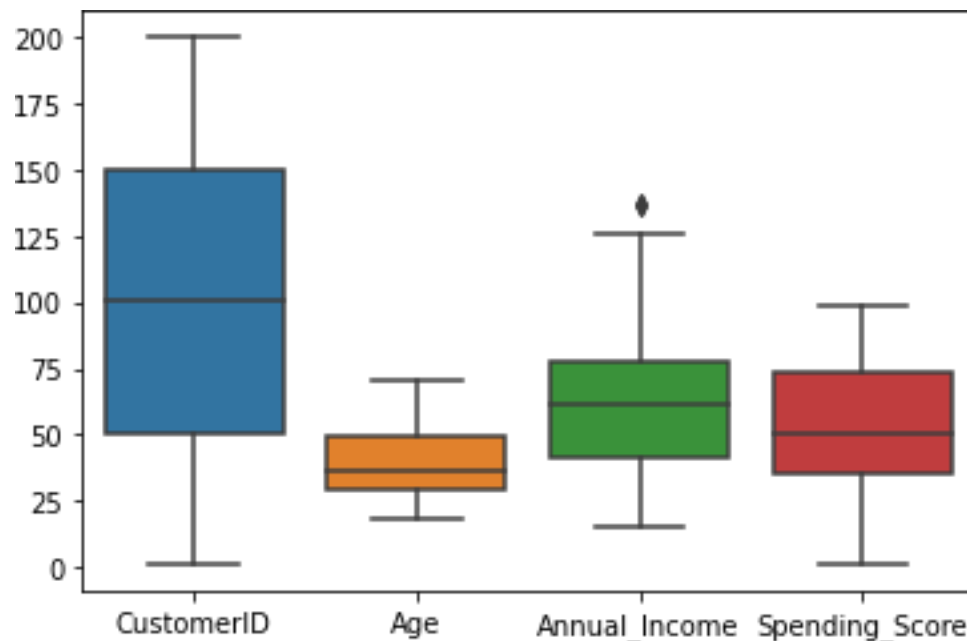
[200 rows x 5 columns]

Checking Outliers

[13]: `sns.boxplot(data=df)`

[13] : <AxesSubplot:>

Description About the Dataset

[14]: `df.describe()`

[14] :

	CustomerID	Age	Annual_Income	Spending_Score
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
```

[15]: `df.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   200 non-null    int64
 4   Spending_Score  200 non-null    int64
dtypes: int64(4), object(1)
memory usage: 7.9+ KB
```

Label Encoding for Gender

[16]: `df["Gender"]=df["Gender"].replace(["Male","Female"],[0,1])`

[17]: `df.head()`

[17]:

	CustomerID	Gender	Age	Annual_Income	Spending_Score
0	1	0	19	15	39
1	2	0	21	15	81
2	3	1	20	16	6
3	4	1	23	16	77
4	5	1	31	17	40

[18]: `df.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    int64
 2   Age             200 non-null    int64
 3   Annual_Income   200 non-null    int64
 4   Spending_Score  200 non-null    int64
dtypes: int64(5)
memory usage: 7.9 KB
```

Multivariant Plot

```
[19]: sns.pairplot(df)
```

[19]: <seaborn.axisgrid.PairGrid at 0x15b13bb63a0>
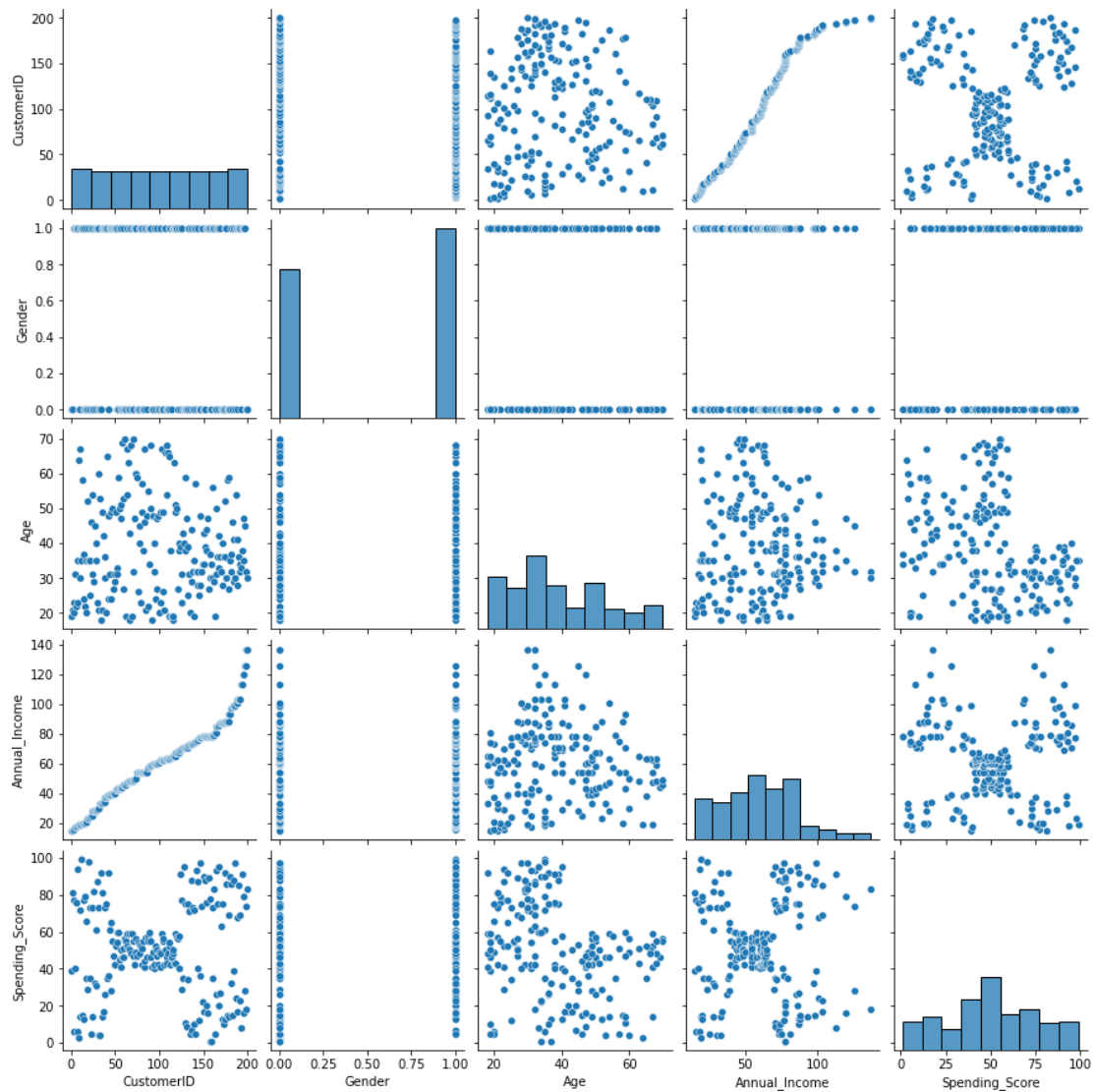
Scaling The Data

```
[20]: scaler = StandardScaler()
      scaler.fit(df)
```

[20]: StandardScaler()

```
[21]: print(scaler.transform(df))
```

[[-1.7234121 -1.12815215 -1.42456879 -1.73899919 -0.43480148]

```
[-1.70609137 -1.12815215 -1.28103541 -1.73899919  1.19570407]
[-1.68877065  0.88640526 -1.3528021  -1.70082976 -1.71591298]
[-1.67144992  0.88640526 -1.13750203 -1.70082976  1.04041783]
[-1.6541292   0.88640526 -0.56336851 -1.66266033 -0.39597992]
[-1.63680847  0.88640526 -1.20926872 -1.66266033  1.00159627]
[-1.61948775  0.88640526 -0.27630176 -1.62449091 -1.71591298]
[-1.60216702  0.88640526 -1.13750203 -1.62449091  1.70038436]
[-1.5848463  -1.12815215  1.80493225 -1.58632148 -1.83237767]
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[-1.53288413  0.88640526 -0.27630176 -1.58632148  1.89449216]
[-1.5155634   0.88640526  1.37433211 -1.54815205 -1.36651894]
[-1.49824268  0.88640526 -1.06573534 -1.54815205  1.04041783]
[-1.48092195 -1.12815215 -0.13276838 -1.54815205 -1.44416206]
[-1.46360123 -1.12815215 -1.20926872 -1.54815205  1.11806095]
[-1.4462805   0.88640526 -0.27630176 -1.50998262 -0.59008772]
[-1.42895978 -1.12815215 -1.3528021  -1.50998262  0.61338066]
[-1.41163905 -1.12815215  0.94373197 -1.43364376 -0.82301709]
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[-1.35967688 -1.12815215 -0.99396865 -1.39547433  0.88513158]
[-1.34235616  0.88640526  0.51313183 -1.3573049  -1.75473454]
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[-1.23843181  0.88640526  0.08253169 -1.20462718 -0.74537397]
[-1.22111108  0.88640526 -1.13750203 -1.20462718  1.42863343]
[-1.20379036 -1.12815215  1.51786549 -1.16645776 -1.7935561 ]
[-1.18646963  0.88640526 -1.28103541 -1.16645776  0.88513158]
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[-1.15182818 -1.12815215 -1.49633548 -1.05194947  1.62274124]
[-1.13450746  0.88640526  0.7284319  -1.05194947 -1.4053405 ]
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[-0.94397949  0.88640526 -1.06573534 -0.82293289  0.5745591 ]
[-0.92665877  0.88640526  0.80019859 -0.78476346  0.18634349]
[-0.90933804  0.88640526 -0.85043527 -0.78476346 -0.12422899]
[-0.89201732  0.88640526 -0.70690189 -0.78476346 -0.3183368 ]
```

```
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[−0.07794326 −1.12815215 −1.06573534 −0.02137488 0.06987881]
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```

```
[-0.04330181  0.88640526 -0.85043527 -0.02137488 -0.00776431]
[-0.02598109 -1.12815215  0.65666521  0.01679455 -0.3183368 ]
[-0.00866036 -1.12815215 -1.3528021   0.01679455 -0.04658587]
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[ 0.02598109  0.88640526  0.7284319   0.05496398 -0.08540743]
[ 0.04330181 -1.12815215  2.02023231  0.05496398  0.34162973]
[ 0.06062254 -1.12815215 -0.92220196  0.05496398  0.18634349]
[ 0.07794326 -1.12815215  0.7284319   0.05496398  0.22516505]
[ 0.09526399  0.88640526 -1.28103541  0.05496398 -0.3183368 ]
[ 0.11258471  0.88640526  1.94846562  0.09313341 -0.00776431]
[ 0.12990543 -1.12815215  1.08726535  0.09313341 -0.16305055]
[ 0.14722616 -1.12815215  2.091999    0.09313341 -0.27951524]
[ 0.16454688 -1.12815215  1.94846562  0.09313341 -0.08540743]
[ 0.18186761 -1.12815215  1.87669894  0.09313341  0.06987881]
[ 0.19918833  0.88640526 -1.42456879  0.09313341  0.14752193]
[ 0.21650906  0.88640526 -0.06100169  0.13130284 -0.3183368 ]
[ 0.23382978 -1.12815215 -1.42456879  0.13130284 -0.16305055]
[ 0.25115051  0.88640526 -1.49633548  0.16947227 -0.08540743]
[ 0.26847123  0.88640526 -1.42456879  0.16947227 -0.00776431]
[ 0.28579196  0.88640526  1.73316556  0.16947227 -0.27951524]
[ 0.30311268  0.88640526  0.7284319   0.16947227  0.34162973]
[ 0.3204334   0.88640526  0.87196528  0.24581112 -0.27951524]
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[ 0.3897163   0.88640526  0.08253169  0.32214998  0.30280817]
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[ 0.42435775  0.88640526 -1.13750203  0.36031941 -0.82301709]
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[ 0.5282821  -1.12815215  0.58489852  0.39848884 -1.5994483 ]
[ 0.54560282 -1.12815215  0.010765    0.39848884  0.96277471]
[ 0.56292355  0.88640526 -0.99396865  0.43665827 -0.62890928]
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[ 0.597565   -1.12815215 -1.3528021   0.4748277  -1.75473454]
[ 0.61488572  0.88640526 -0.70690189  0.4748277   1.46745499]
[ 0.63220645  0.88640526  0.36959845  0.4748277  -1.67709142]
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[ 0.70148935  0.88640526  1.30256542  0.55116656 -1.75473454]
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[ 0.77077224 -1.12815215 -0.99396865  0.62750542 -1.48298362]
```

```
[ 0.78809297  -1.12815215  -0.77866858   0.62750542   1.81684904]
[ 0.80541369  -1.12815215   0.65666521   0.62750542  -0.55126616]
[ 0.82273442   0.88640526  -0.49160182   0.62750542   0.92395314]
[ 0.84005514   0.88640526  -0.34806844   0.66567484  -1.09476801]
[ 0.85737587  -1.12815215  -0.34806844   0.66567484   1.54509812]
[ 0.87469659  -1.12815215   0.29783176   0.66567484  -1.28887582]
[ 0.89201732  -1.12815215   0.010765     0.66567484   1.46745499]
[ 0.90933804   0.88640526   0.36959845   0.66567484  -1.17241113]
[ 0.92665877   0.88640526  -0.06100169   0.66567484   1.00159627]
[ 0.94397949   0.88640526   0.58489852   0.66567484  -1.32769738]
[ 0.96130021   0.88640526  -0.85043527   0.66567484   1.50627656]
[ 0.97862094  -1.12815215  -0.13276838   0.66567484  -1.91002079]
[ 0.99594166   0.88640526  -0.6351352    0.66567484   1.07923939]
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[ 1.08254529  -1.12815215  -1.42456879   0.78018313  -1.75473454]
[ 1.09986601   0.88640526  -0.56336851   0.78018313   1.6615628 ]
[ 1.11718674  -1.12815215   0.80019859   0.93286085  -0.93948177]
[ 1.13450746   0.88640526  -0.20453507   0.93286085   0.96277471]
[ 1.15182818  -1.12815215   0.22606507   0.97103028  -1.17241113]
[ 1.16914891   0.88640526  -0.41983513   0.97103028   1.73920592]
[ 1.18646963   0.88640526  -0.20453507   1.00919971  -0.90066021]
[ 1.20379036  -1.12815215  -0.49160182   1.00919971   0.49691598]
[ 1.22111108  -1.12815215   0.08253169   1.00919971  -1.44416206]
[ 1.23843181  -1.12815215  -0.77866858   1.00919971   0.96277471]
[ 1.25575253  -1.12815215  -0.20453507   1.00919971  -1.56062674]
[ 1.27307326  -1.12815215  -0.20453507   1.00919971   1.62274124]
[ 1.29039398   0.88640526   0.94373197   1.04736914  -1.44416206]
[ 1.30771471   0.88640526  -0.6351352    1.04736914   1.38981187]
[ 1.32503543  -1.12815215   1.37433211   1.04736914  -1.36651894]
[ 1.34235616  -1.12815215  -0.85043527   1.04736914   0.72984534]
[ 1.35967688  -1.12815215   1.4460988    1.23821628  -1.4053405 ]
[ 1.3769976   -1.12815215  -0.27630176   1.23821628   1.54509812]
[ 1.39431833   0.88640526  -0.13276838   1.390894    -0.7065524 ]
[ 1.41163905   0.88640526  -0.49160182   1.390894     1.38981187]
[ 1.42895978  -1.12815215   0.51313183   1.42906343  -1.36651894]
[ 1.4462805    0.88640526  -0.70690189   1.42906343   1.46745499]
[ 1.46360123   0.88640526   0.15429838   1.46723286  -0.43480148]
[ 1.48092195  -1.12815215  -0.6351352    1.46723286   1.81684904]
[ 1.49824268   0.88640526   1.08726535   1.54357172  -1.01712489]
[ 1.5155634   -1.12815215  -0.77866858   1.54357172   0.69102378]
[ 1.53288413   0.88640526   0.15429838   1.61991057  -1.28887582]
[ 1.55020485   0.88640526  -0.20453507   1.61991057   1.35099031]
[ 1.56752558   0.88640526  -0.34806844   1.61991057  -1.05594645]
[ 1.5848463    0.88640526  -0.49160182   1.61991057   0.72984534]
[ 1.60216702  -1.12815215  -0.41983513   2.00160487  -1.63826986]
```

```
      [ 1.61948775 0.88640526 -0.06100169 2.00160487 1.58391968]
      [ 1.63680847 0.88640526 0.58489852 2.26879087 -1.32769738]
      [ 1.6541292  0.88640526 -0.27630176 2.26879087 1.11806095]
      [ 1.67144992 0.88640526 0.44136514 2.49780745 -0.86183865]
      [ 1.68877065 -1.12815215 -0.49160182 2.49780745 0.92395314]
      [ 1.70609137 -1.12815215 -0.49160182 2.91767117 -1.25005425]
      [ 1.7234121  -1.12815215 -0.6351352 2.91767117 1.27334719]]
```

[22]:
```python
X = df.iloc[:, [3, 4]].values
```

[23]:
```python
X
```

[23]:
```
array([[ 15,   39],
       [ 15,   81],
       [ 16,    6],
       [ 16,   77],
       [ 17,   40],
       [ 17,   76],
       [ 18,    6],
       [ 18,   94],
       [ 19,    3],
       [ 19,   72],
       [ 19,   14],
       [ 19,   99],
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       [ 24,   35],
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       [ 25,    5],
       [ 25,   73],
       [ 28,   14],
       [ 28,   82],
       [ 28,   32],
       [ 28,   61],
       [ 29,   31],
       [ 29,   87],
       [ 30,    4],
       [ 30,   73],
       [ 33,    4],
       [ 33,   92],
       [ 33,   14],
```

```
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[ 34,   73],
[ 37,   26],
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[ 38,   92],
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[ 54,   52],
[ 54,   42],
[ 54,   51],
[ 54,   55],
```

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```

```
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[ 85,    75],
[ 86,    20],
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[ 87,    27],
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[ 87,    13],
[ 87,    75],
[ 87,    10],
[ 87,    92],
[ 88,    13],
[ 88,    86],
```

```
       [ 88,   15],
       [ 88,   69],
       [ 93,   14],
       [ 93,   90],
       [ 97,   32],
       [ 97,   86],
       [ 98,   15],
       [ 98,   88],
       [ 99,   39],
       [ 99,   97],
       [101,   24],
       [101,   68],
       [103,   17],
       [103,   85],
       [103,   23],
       [103,   69],
       [113,    8],
       [113,   91],
       [120,   16],
       [120,   79],
       [126,   28],
       [126,   74],
       [137,   18],
       [137,   83]], dtype=int64)
```

DBSCAN Clustering Algorithm

```
[24]: from sklearn.cluster import DBSCAN
      dbscan=DBSCAN(eps=3,min_samples=4)
```

```
[25]: model=dbscan.fit(X)
      labels=model.labels_
```

```
[26]: from sklearn import metrics
```

```
[27]: sample_cores=np.zeros_like(labels,dtype=bool)
      sample_cores[dbscan.core_sample_indices_]=True
```

```
[28]: #Calculating the number of clusters
      n_clusters=len(set(labels))- (1 if -1 in labels else 0)
```
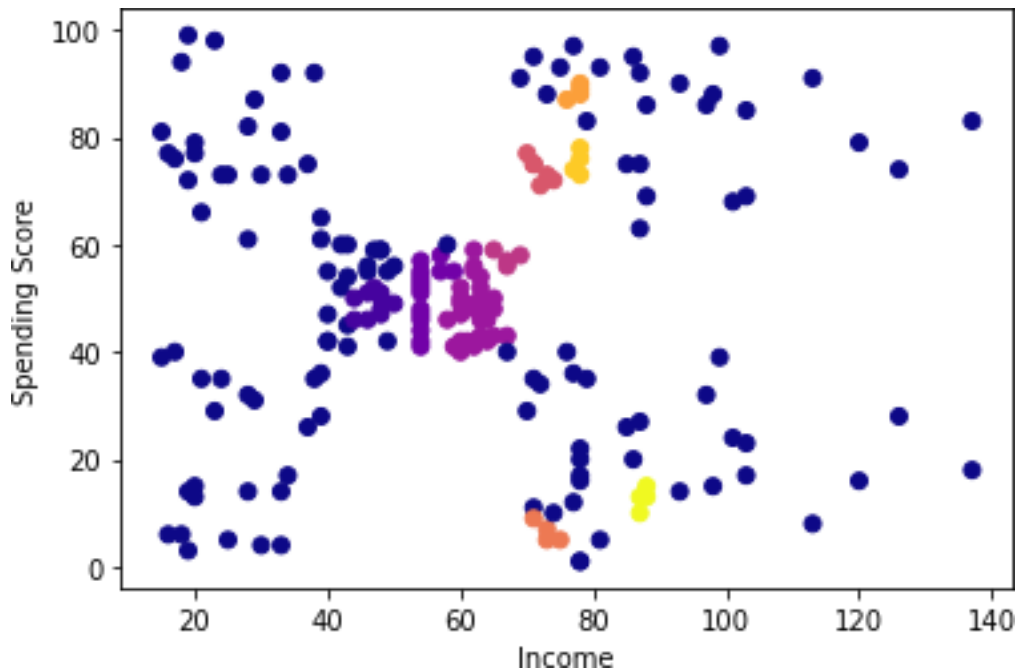
```
[29]: n_clusters
```

```
[29]: 9
```

```
[30]: print(metrics.silhouette_score(X,labels))
```

```
-0.1908319132560097
```
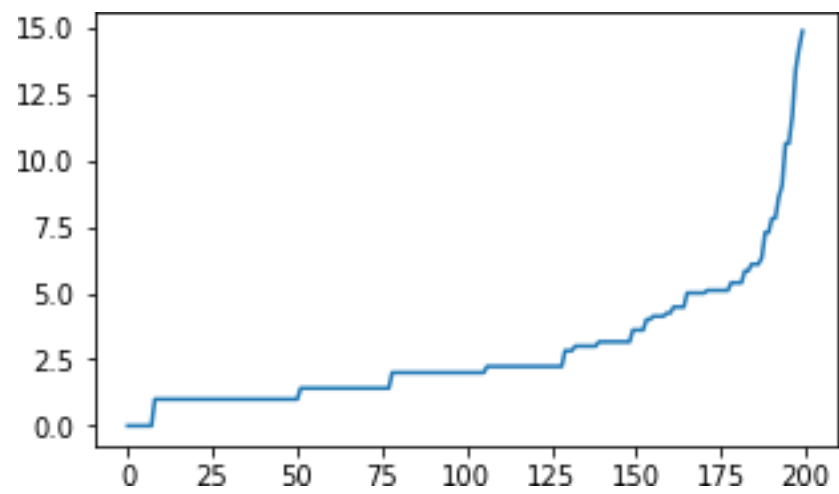
```
[31]: # Plot the clusters
      plt.scatter(X[:, 0], X[:,1], c = labels, cmap= "plasma") # plotting the clusters
      plt.xlabel("Income") # X-axis label
      plt.ylabel("Spending Score") # Y-axis label
      plt.show() # showing the plot
```


KNN Algorithm

```
[32]: from sklearn.neighbors import NearestNeighbors # importing the library
      neighb = NearestNeighbors(n_neighbors=2) # creating an object of the
       ↪NearestNeighbors class
      nbrs=neighb.fit(X) # fitting the data to the object
      distances,indices=nbrs.kneighbors(X) # finding the nearest neighbours
```

```
[33]: # Sort and plot the distances results
      distances = np.sort(distances, axis = 0) # sorting the distances
      distances = distances[:, 1] # taking the second column of the sorted distances
      plt.rcParams["figure.figsize"] = (5,3) # setting the figure size
      plt.plot(distances) # plotting the distances
      plt.show() # showing the plot
```

[ ]:

[ ]: