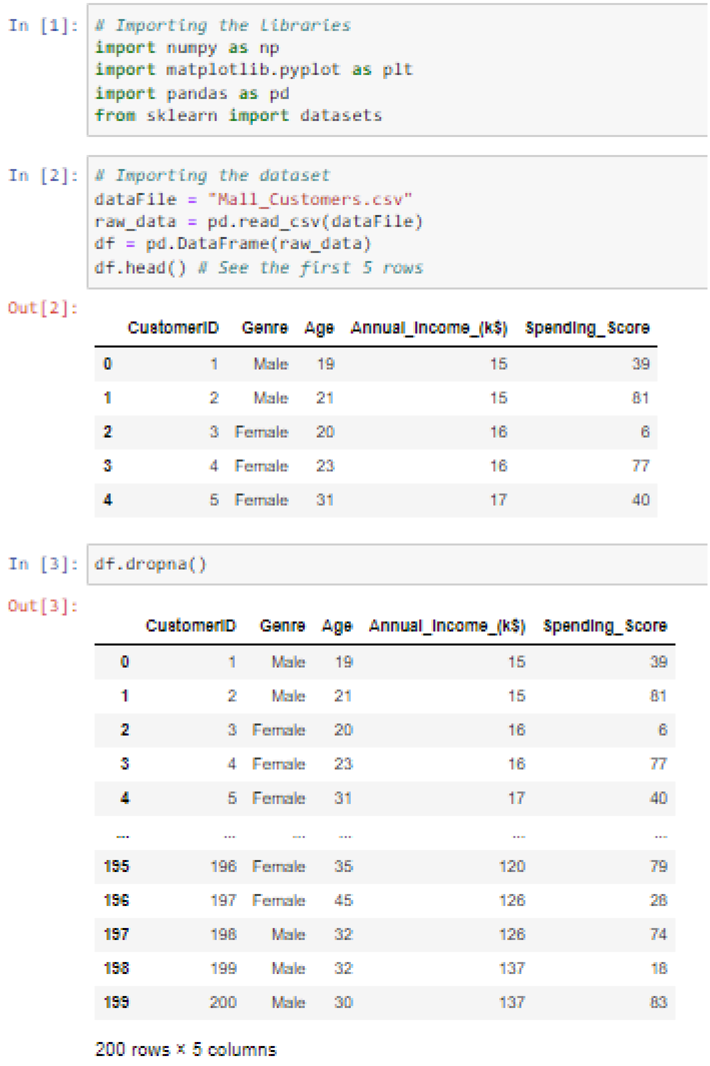
Institute of Computer Technology
B. Tech Computer Science and Engineering
Sub: Data Mining and Warehousing (2CSE60E27)

PRACTICAL 9: CLUSTERING

A dataset of a Mall (File Name-"Mall_Customer.csv") is provided to you for this practical. It contains the information about the customer with different attributes such as customer ID, Age, Gender, annual income and as per the spending the customer has done, some spending scores are assigned to them. As a data analyst, you need to find out similar kind of customers. This information will be helpful to target a specific group of customers for the sale of products.
Try to answer these questions and create the group of customers as per the details provided in the dataset. Also, provide the visualization of the groups that are being made.

```
# Importing the libraries
import numpy as np
import matplotlib.pyplot as plt
import pandas as pd
from sklearn import datasets

# Importing the dataset
dataFile = "Mall_Customers.csv"
raw_data = pd.read_csv(dataFile)
df = pd.DataFrame(raw_data)
df.head() # See the first 5 rows

df.dropna()

x = df.iloc[:, [3, 4]].values
x

x = df.iloc[:, [3, 4]].values
from sklearn.cluster import KMeans
wcss = []
for i in range(1, 11):
 kmeans = KMeans(n_clusters = i, init = 'k-means++',max_iter = 300, n_init = 10,
random_state = 0)
 kmeans.fit(x)
 wcss.append(kmeans.inertia_)
plt.plot(range(1, 11), wcss)
plt.title('The elbow method')
plt.xlabel('Number of clusters')
plt.ylabel('WCSS')
plt.show()
```

```
# Applying kmeans to the dataset / Creating the kmeans classifier
kmeans = KMeans(n_clusters = 5, init = 'k-means++',
max_iter = 300, n_init = 10, random_state = 0)
y_kmeans = kmeans.fit_predict(x)

import seaborn as sns
plt.figure(figsize=(10,5))
sns.lineplot(range(1,11),wcss,marker='o',color='blue')
plt.title('Elbow method')
plt.show()

# Applying kmeans to the dataset / Creating the kmeans classifier
kmeans = KMeans(n_clusters = 5, init = 'k-means++',
max_iter = 300, n_init = 10, random_state = 0)
y_kmeans = kmeans.fit_predict(x)
#i above is between 1-10 numbers.
#init parameter is the random initialization method
#we select kmeans++ method. max_iter parameter the maximum number of iterations there can be to
#find the final clusters when the K-meands algorithm is running.
#Enter the default value of 300
#the next parameter is n_init which is the number of times the
#K_means algorithm will be run with different initial centroid.

# Visualising the clusters - On the first two columns
plt.scatter(x[y_kmeans == 0, 0], x[y_kmeans == 0, 1], s = 100, c = 'red', label = 'Cluster_1')
plt.scatter(x[y_kmeans == 1, 0], x[y_kmeans == 1, 1], s = 100, c = 'blue', label = 'Cluster_2')
plt.scatter(x[y_kmeans == 2, 0], x[y_kmeans == 2, 1],s = 100, c = 'green', label = 'Cluster_3')
plt.scatter(x[y_kmeans == 3, 0], x[y_kmeans == 3, 1],s = 100, c = 'violet', label = 'Cluster_4')
plt.scatter(x[y_kmeans == 4, 0], x[y_kmeans == 4, 1],s = 100, c = 'black', label = 'Cluster_5')
plt.scatter(kmeans.cluster_centers_[:, 0], kmeans.cluster_centers_[:, 1], s = 100, color = 'orange', label = 'Centroids')
plt.legend()

sns.scatterplot('Annual_Income_(k$)','Spending_Score',data=raw_data,s=200)
sns.scatterplot('Annual_Income_(k$)','Spending_Score',hue='Genre',data=raw_data,s=200)

# How the customers will be identified and grouped?
print("Question: How the customers will be identified and grouped? ")
print("Answer: Customers will be identified and grouped based on Annual Income & Spending Score ")
df.head() # See the first 5 rows

# Which attributes is contributing the most to identify the group of customers?
print("Question: Which attributes is contributing the most to identify the group of customers? ")
print("Answer: Spending Score is contributing the most to identify the group of customers
")
df.corr()

# How many such groups can be created?
print("Question: How many such groups can be created? ")
plt.scatter(x[y_kmeans == 0, 0], x[y_kmeans == 0, 1], s = 100, c = 'red', label = 'Cluster_1')
plt.scatter(x[y_kmeans == 1, 0], x[y_kmeans == 1, 1], s = 100, c = 'blue', label = 'Cluster_2')
plt.scatter(x[y_kmeans == 2, 0], x[y_kmeans == 2, 1],s = 100, c = 'green', label = 'Cluster_3')
plt.scatter(x[y_kmeans == 3, 0], x[y_kmeans == 3, 1],s = 100, c = 'violet', label = 'Cluster_4')
plt.scatter(x[y_kmeans == 4, 0], x[y_kmeans == 4, 1],s = 100, c = 'black', label = 'Cluster_5')
plt.scatter(kmeans.cluster_centers_[:, 0], kmeans.cluster_centers_[:, 1], s = 100, color =
'orange', label = 'Centroids')
plt.legend()
print("Answer: Total 5 Groups can be created as shown in the plot (Here we can see
elbow is created in elbow method at 5 so it is further used as cluster in kmeans
algorithm)")
```



In [1]:

```
# Importing the libraries
import numpy as np
import matplotlib.pyplot as plt
import pandas as pd
from sklearn import datasets
```

In [2]:

```
# Importing the dataset
dataFile = "Mall_Customers.csv"
raw_data = pd.read_csv(dataFile)
df = pd.DataFrame(raw_data)
df.head() # See the first 5 rows
```

Out[2]:

	CustomerID	Genre	Age	Annual_Income_(k$)	Spending_Score
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

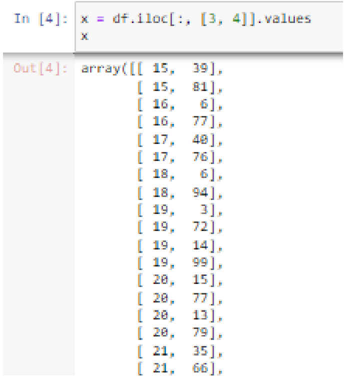
In [3]:

```
df.dropna()
```

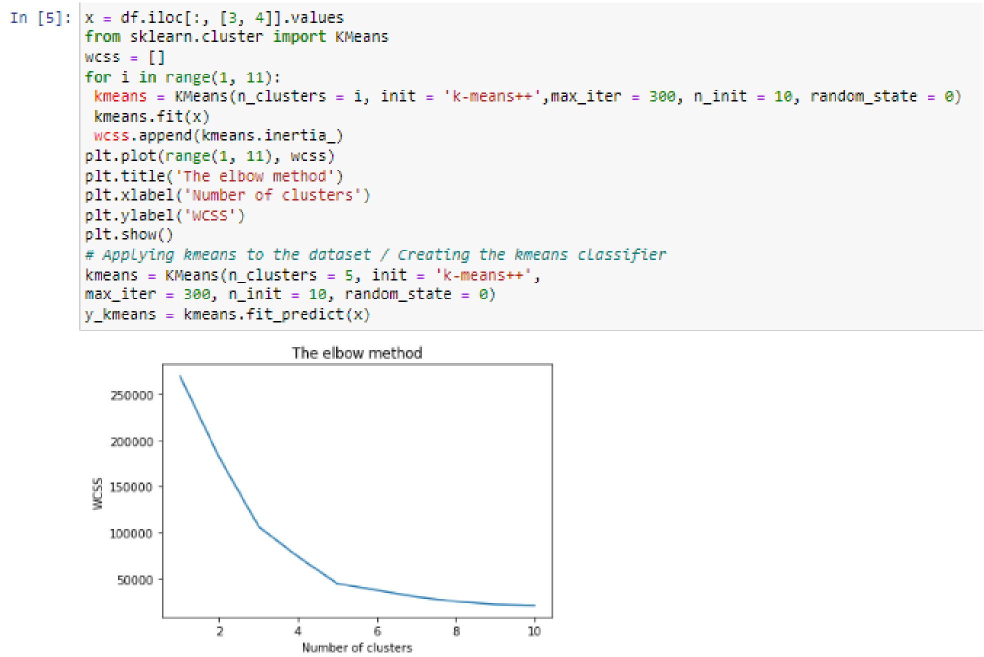
Out[3]:

	CustomerID	Genre	Age	Annual_Income_(k$)	Spending_Score
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

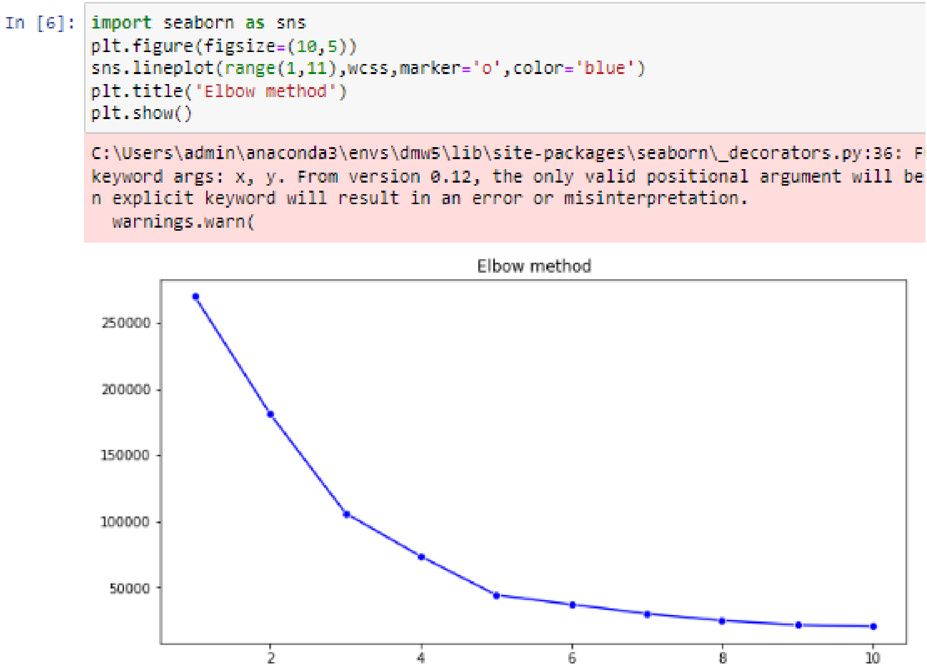
200 rows × 5 columns



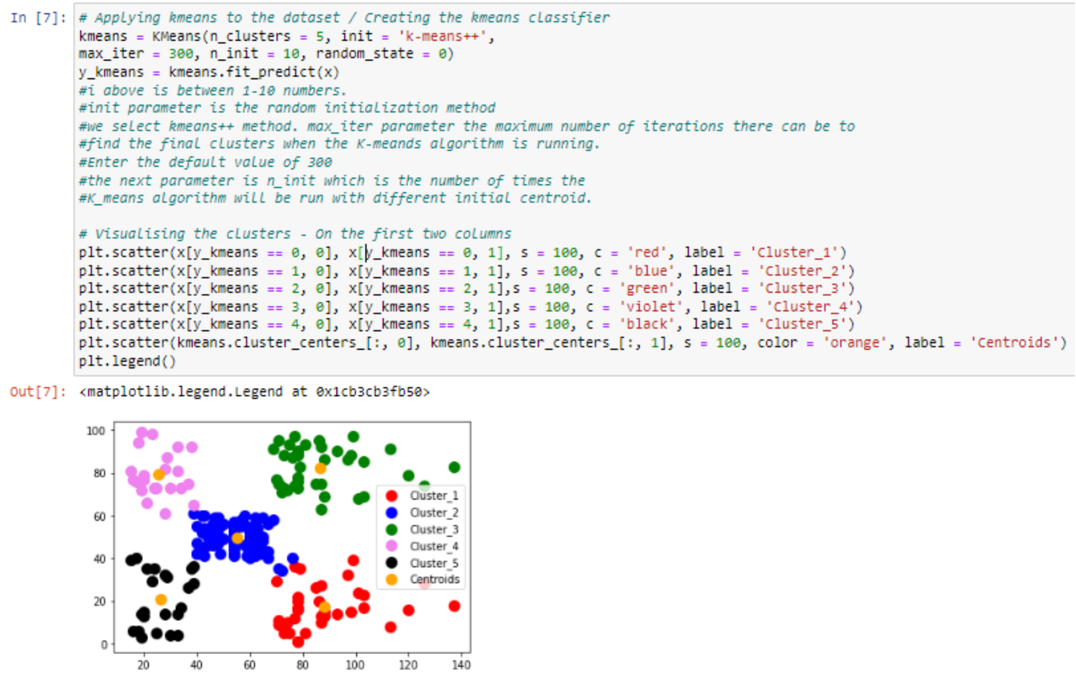
```
In [4]: x = df.iloc[:, [3, 4]].values
        x

Out[4]: 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],
               [ 20,  15],
               [ 20,  77],
               [ 20,  13],
               [ 20,  79],
               [ 21,  35],
               [ 21,  66],
```



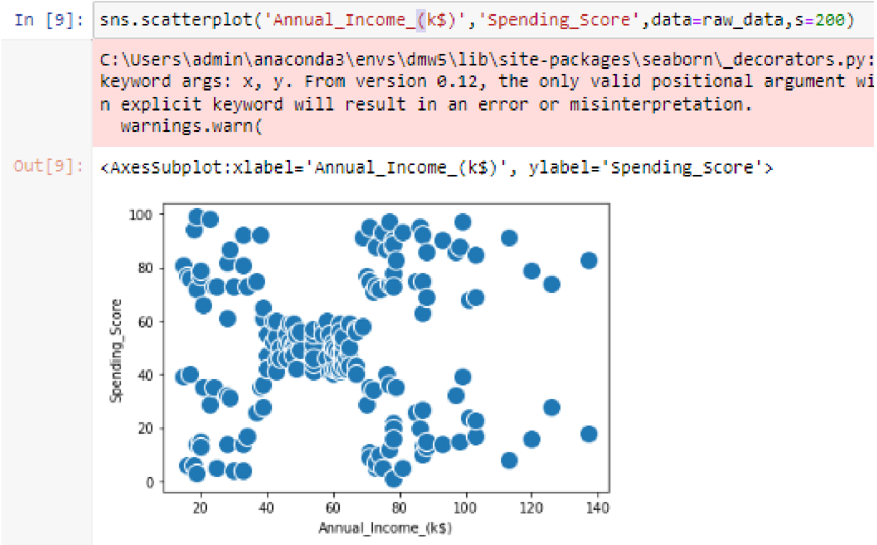
```
In [5]: x = df.iloc[:, [3, 4]].values
        from sklearn.cluster import KMeans
        wcss = []
        for i in range(1, 11):
         kmeans = KMeans(n_clusters = i, init = 'k-means++',max_iter = 300, n_init = 10, random_state = 0)
         kmeans.fit(x)
         wcss.append(kmeans.inertia_)
        plt.plot(range(1, 11), wcss)
        plt.title('The elbow method')
        plt.xlabel('Number of clusters')
        plt.ylabel('WCSS')
        plt.show()
        # Applying kmeans to the dataset / Creating the kmeans classifier
        kmeans = KMeans(n_clusters = 5, init = 'k-means++',
        max_iter = 300, n_init = 10, random_state = 0)
        y_kmeans = kmeans.fit_predict(x)
```



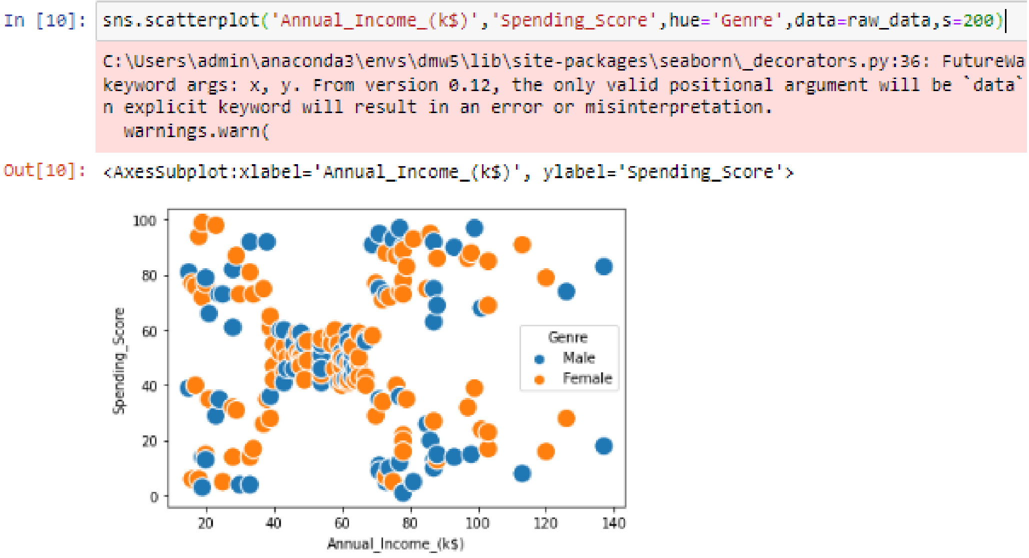
```
In [6]: import seaborn as sns
        plt.figure(figsize=(10,5))
        sns.lineplot(range(1,11),wcss,marker='o',color='blue')
        plt.title('Elbow method')
        plt.show()

        C:\Users\admin\anaconda3\envs\dmw5\lib\site-packages\seaborn\_decorators.py:36: F
        keyword args: x, y. From version 0.12, the only valid positional argument will be
        n explicit keyword will result in an error or misinterpretation.
          warnings.warn(
```



```
In [7]: # Applying kmeans to the dataset / Creating the kmeans classifier
        kmeans = KMeans(n_clusters = 5, init = 'k-means++',
        max_iter = 300, n_init = 10, random_state = 0)
        y_kmeans = kmeans.fit_predict(x)
        #i above is between 1-10 numbers.
        #init parameter is the random initialization method
        #we select kmeans++ method. max_iter parameter the maximum number of iterations there can be to
        #find the final clusters when the K-meands algorithm is running.
        #Enter the default value of 300
        #the next parameter is n_init which is the number of times the
        #K_means algorithm will be run with different initial centroid.

        # Visualising the clusters - On the first two columns
        plt.scatter(x[y_kmeans == 0, 0], x[y_kmeans == 0, 1], s = 100, c = 'red', label = 'Cluster_1')
        plt.scatter(x[y_kmeans == 1, 0], x[y_kmeans == 1, 1], s = 100, c = 'blue', label = 'Cluster_2')
        plt.scatter(x[y_kmeans == 2, 0], x[y_kmeans == 2, 1],s = 100, c = 'green', label = 'Cluster_3')
        plt.scatter(x[y_kmeans == 3, 0], x[y_kmeans == 3, 1],s = 100, c = 'violet', label = 'Cluster_4')
        plt.scatter(x[y_kmeans == 4, 0], x[y_kmeans == 4, 1],s = 100, c = 'black', label = 'Cluster_5')
        plt.scatter(kmeans.cluster_centers_[:, 0], kmeans.cluster_centers_[:, 1], s = 100, color = 'orange', label = 'Centroids')
        plt.legend()

Out[7]: <matplotlib.legend.Legend at 0x1cb3cb3fb50>
```

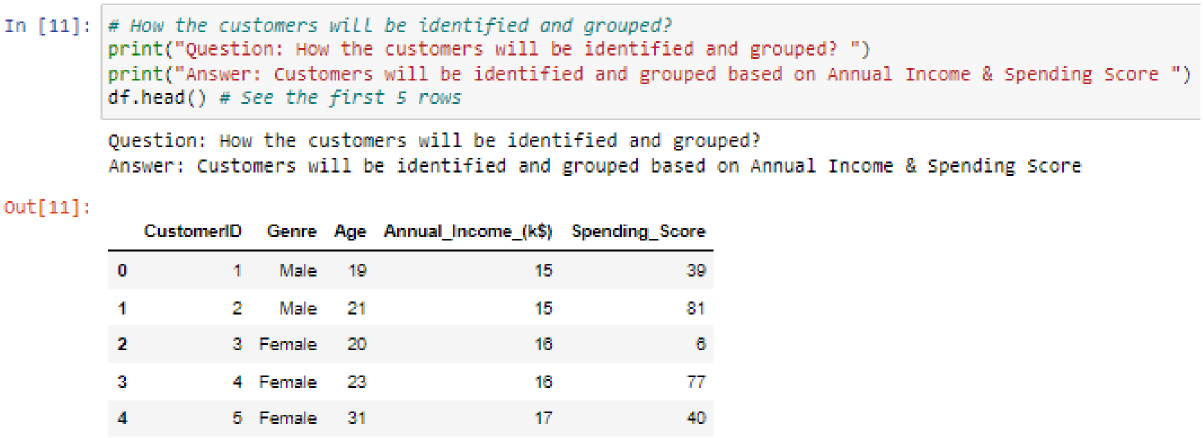


```
In [9]: sns.scatterplot('Annual_Income_(k$)','Spending_Score',data=raw_data,s=200)

        C:\Users\admin\anaconda3\envs\dmw5\lib\site-packages\seaborn\_decorators.py:
        keyword args: x, y. From version 0.12, the only valid positional argument wi
        n explicit keyword will result in an error or misinterpretation.
          warnings.warn(

Out[9]: <AxesSubplot:xlabel='Annual_Income_(k$)', ylabel='Spending_Score'>
```



```
In [10]: sns.scatterplot('Annual_Income_(k$)','Spending_Score',hue='Genre',data=raw_data,s=200)

         C:\Users\admin\anaconda3\envs\dmw5\lib\site-packages\seaborn\_decorators.py:36: FutureWa
         keyword args: x, y. From version 0.12, the only valid positional argument will be `data`
         n explicit keyword will result in an error or misinterpretation.
           warnings.warn(

Out[10]: <AxesSubplot:xlabel='Annual_Income_(k$)', ylabel='Spending_Score'>
```

1. But the question here is how the customer will be identified and grouped?

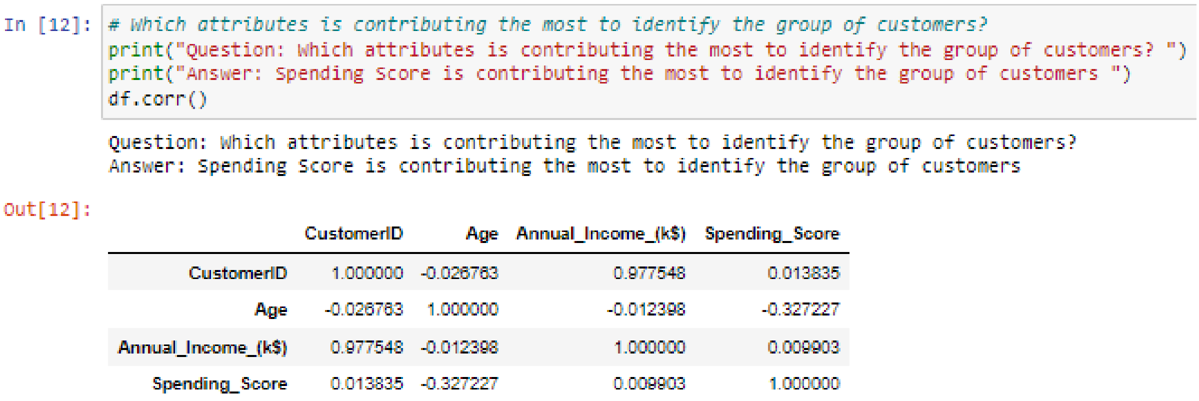


```
In [11]: # How the customers will be identified and grouped?
         print("Question: How the customers will be identified and grouped? ")
         print("Answer: Customers will be identified and grouped based on Annual Income & Spending Score ")
         df.head() # See the first 5 rows

         Question: How the customers will be identified and grouped?
         Answer: Customers will be identified and grouped based on Annual Income & Spending Score
```

Out[11]:

	CustomerID	Genre	Age	Annual_Income_(k$)	Spending_Score
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

2. Which attributes is contributing the most to identify the group of customers?

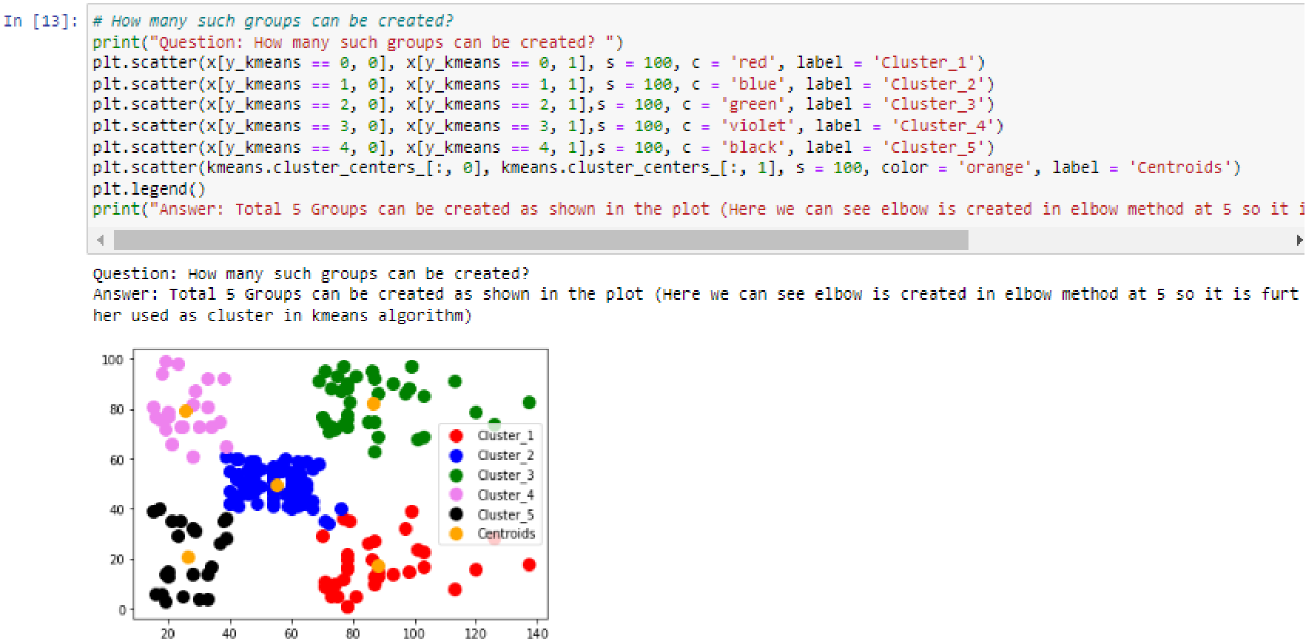


```
In [12]: # Which attributes is contributing the most to identify the group of customers?
         print("Question: Which attributes is contributing the most to identify the group of customers? ")
         print("Answer: Spending Score is contributing the most to identify the group of customers ")
         df.corr()

         Question: Which attributes is contributing the most to identify the group of customers?
         Answer: Spending Score is contributing the most to identify the group of customers
```

Out[12]:

	CustomerID	Age	Annual_Income_(k$)	Spending_Score
CustomerID	1.000000	-0.026763	0.977548	0.013835
Age	-0.026763	1.000000	-0.012398	-0.327227
Annual_Income_(k$)	0.977548	-0.012398	1.000000	0.009903
Spending_Score	0.013835	-0.327227	0.009903	1.000000

3. How many such groups can be created?



```
In [13]: # How many such groups can be created?
         print("Question: How many such groups can be created? ")
         plt.scatter(x[y_kmeans == 0, 0], x[y_kmeans == 0, 1], s = 100, c = 'red', label = 'Cluster_1')
         plt.scatter(x[y_kmeans == 1, 0], x[y_kmeans == 1, 1], s = 100, c = 'blue', label = 'Cluster_2')
         plt.scatter(x[y_kmeans == 2, 0], x[y_kmeans == 2, 1],s = 100, c = 'green', label = 'Cluster_3')
         plt.scatter(x[y_kmeans == 3, 0], x[y_kmeans == 3, 1],s = 100, c = 'violet', label = 'Cluster_4')
         plt.scatter(x[y_kmeans == 4, 0], x[y_kmeans == 4, 1],s = 100, c = 'black', label = 'Cluster_5')
         plt.scatter(kmeans.cluster_centers_[:, 0], kmeans.cluster_centers_[:, 1], s = 100, color = 'orange', label = 'Centroids')
         plt.legend()
         print("Answer: Total 5 Groups can be created as shown in the plot (Here we can see elbow is created in elbow method at 5 so it i

         Question: How many such groups can be created?
         Answer: Total 5 Groups can be created as shown in the plot (Here we can see elbow is created in elbow method at 5 so it is furt
         her used as cluster in kmeans algorithm)
```