In [1]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.cluster import KMeans
```

Data collection & analysis

In [2]:
```
# loading the data from csv file to a Pandas DataFrame
customer_data = pd.read_csv('Mall_Customers.csv')
```

In [3]:
```
# first 5 rows in the dataframe
customer_data.head()
```

Out[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

In [4]:
```
# finding the number of rows and columns
customer_data.shape
```

Out[4]:
```
(200, 5)
```

In [5]:
```
# getting some informations about the dataset
customer_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
```

In [6]:
```
# checking for missing values
customer_data.isnull().sum()
```

Out[6]:
```
CustomerID                0
Gender                    0
Age                       0
Annual Income (k$)        0
Spending Score (1-100)    0
dtype: int64
```

Choosing the Annual Income column & Spending Score column

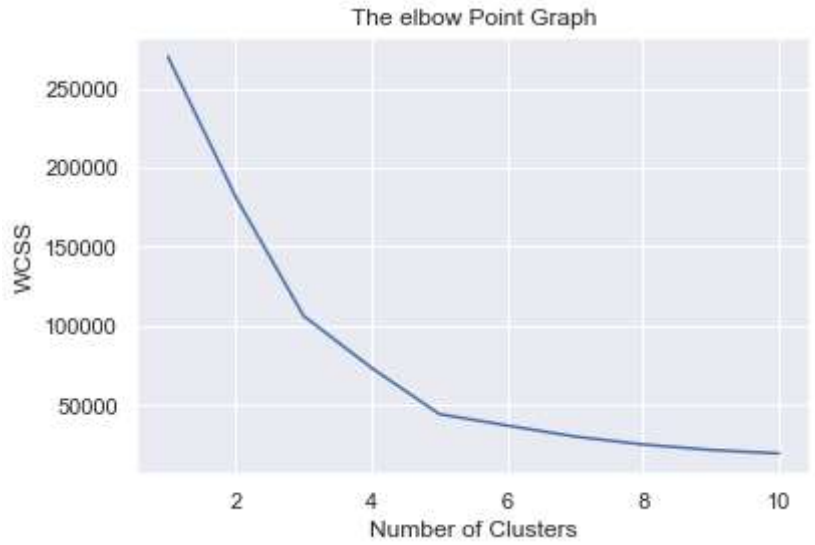
In [7]:
```
X = customer_data.iloc[:,[3,4]].values
```

Choosing the number of clusters

In [8]:
```
# WCSS - Within clusters sum of squares

# finding  wcss vlaue for different number of cluster

wcss = []

for i in range(1,11):
    kmeans = KMeans(n_clusters=i,init='k-means++',random_state=30)
    kmeans.fit(X)
    wcss.append(kmeans.inertia_)
```

```
C:\Users\HP\anaconda3\lib\site-packages\sklearn\cluster\_kmeans.py:1036: UserWa
rning: KMeans is known to have a memory leak on Windows with MKL, when there ar
e less chunks than available threads. You can avoid it by setting the environme
nt variable OMP_NUM_THREADS=1.
  warnings.warn(
```

In [9]:
```
# plot an elbow graph

sns.set()
plt.plot(range(1,11), wcss)
plt.title('The elbow Point Graph')
plt.xlabel('Number of Clusters')
plt.ylabel('WCSS')
plt.show()
```



Optimum number of cluster = 5

Training the KMean Cluster Model

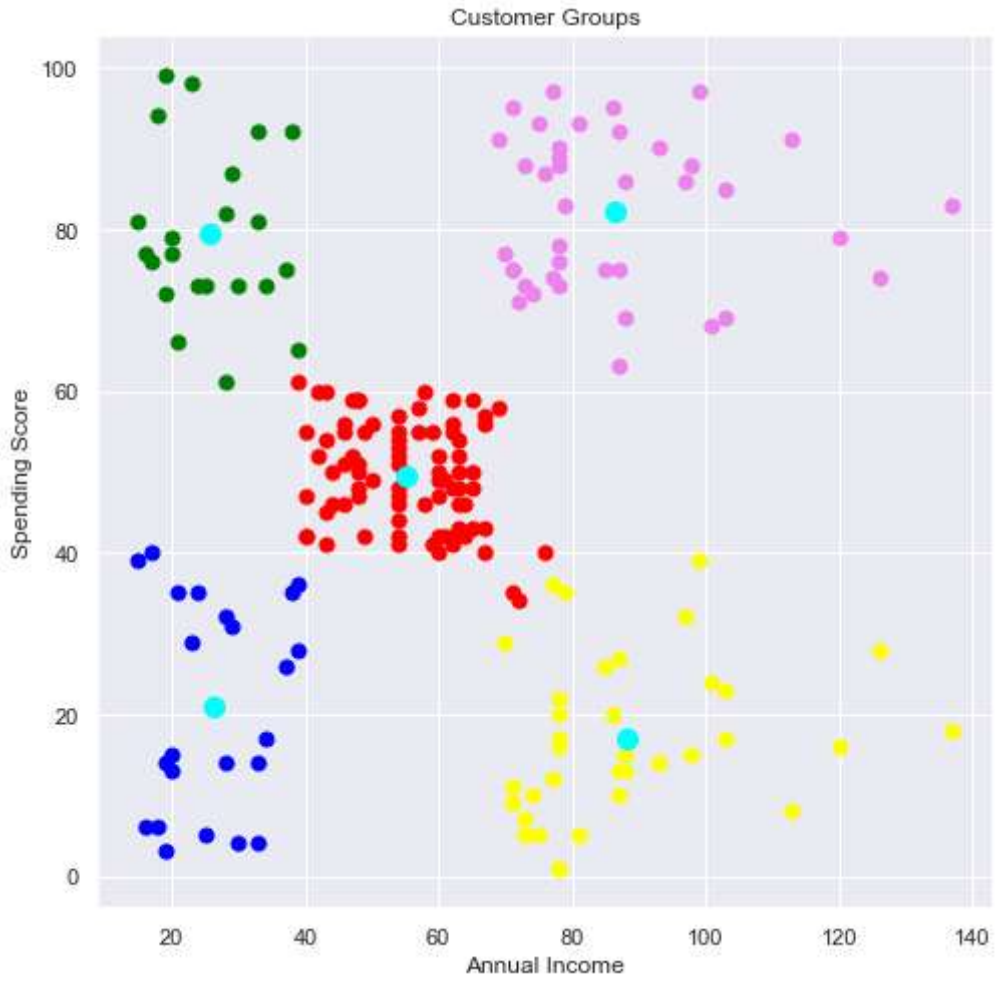
In [10]:
```
kmeans = KMeans(n_clusters=5,init='k-means++',random_state=30)

#return a label for each data point based on their cluster

Y = kmeans.fit_predict(X)
```

In [11]:
```
print(Y)
```

```
[4 0 4 0 4 0 4 0 4 0 4 0 4 0 4 0 4 0 4 0 4 0 4 0 4 0 4 0 4 0 4 0 4 0 4
 0 4 0 4 0 4 1 4 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
 1 1 1 1 1 1 1 1 1 1 1 1 3 2 3 1 3 2 3 2 3 1 3 2 3 2 3 2 3 2 3 1 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 2 3 2 3 2 3 2 3 2 3 2 3 2 3]
```

Visualizing all the Clusters

In [12]:
```
# plotting all the clusters and their Centroids

plt.figure(figsize=(8,8))
plt.scatter(X[Y==0,0], X[Y==0,1], s=50, c='green', label='Cluster 1')
plt.scatter(X[Y==1,0], X[Y==1,1], s=50, c='red', label='Cluster 2')
plt.scatter(X[Y==2,0], X[Y==2,1], s=50, c='yellow', label='Cluster 3')
plt.scatter(X[Y==3,0], X[Y==3,1], s=50, c='violet', label='Cluster 4')
plt.scatter(X[Y==4,0], X[Y==4,1], s=50, c='blue', label='Cluster 5')

# plot the centroids
plt.scatter(kmeans.cluster_centers_[:,0], kmeans.cluster_centers_[:,1], s=100, c=

plt.title('Customer Groups')
plt.xlabel('Annual Income')
plt.ylabel('Spending Score')
plt.show()
```



We can give these information to different teams of the company, so that they can make offers accordingly.