In [31]:
```
#importing libraries
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.cluster import KMeans
```

In [32]:
```
### CREATE VIRTUAL DISPLAY ###
!apt-get install -y xvfb # Install X Virtual Frame Buffer
import os
os.system('Xvfb :1 -screen 0 1600x1200x16  &')    # create virtual display with size 1600x
os.environ['DISPLAY']=':1.0'    # tell X clients to use our virtual DISPLAY :1.0.
```

```
'apt-get' is not recognized as an internal or external command,
operable program or batch file.
```

In [33]:
```
#loading the data from csv file using pandas
customer_data=pd.read_csv('Mall_Customers.csv')
```

In [34]:
```
#printing first five rows
customer_data.head()
```

Out[34]:

	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 [35]:
```
#finding the no.of rows and columns
customer_data.shape
```

Out[35]:
```
(200, 5)
```

In [36]:
```
#200 rows 5 columns(features)
#getting some information 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 [37]:
```
#checking for missing values
customer_data.isnull().sum()
```

Out[37]:
```
CustomerID                0
Gender                    0
Age                       0
Annual Income (k$)        0
Spending Score (1-100)    0
dtype: int64
```

In [38]:
```
#choosing which columns to choose for clustering.here we chose annual income and spending
x=customer_data.iloc[:,[3,4]].values
```

In [39]:
```
print(x)
```

```
[[ 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]
 [ 23  29]
 [ 23  98]
 [ 24  35]
 [ 24  73]
 [ 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]
 [ 33  81]
 [ 34  17]
 [ 34  73]
 [ 37  26]
 [ 37  75]
 [ 38  35]
 [ 38  92]
 [ 39  36]
 [ 39  61]
 [ 39  28]
```

```
[ 40  55]
[ 40  47]
[ 40  42]
[ 40  42]
[ 42  52]
[ 42  60]
[ 43  54]
[ 43  60]
[ 43  45]
[ 43  41]
[ 44  50]
[ 44  46]
[ 46  51]
[ 46  46]
[ 46  56]
[ 46  55]
[ 47  52]
[ 47  59]
[ 48  51]
[ 48  59]
[ 48  50]
[ 48  48]
[ 48  59]
[ 48  47]
[ 49  55]
[ 49  42]
[ 50  49]
[ 50  56]
[ 54  47]
[ 54  54]
[ 54  53]
[ 54  48]
[ 54  52]
[ 54  42]
[ 54  51]
[ 54  55]
[ 54  41]
[ 54  44]
[ 54  57]
[ 54  46]
[ 57  58]
[ 57  55]
[ 58  60]
[ 58  46]
[ 59  55]
[ 59  41]
[ 60  49]
[ 60  40]
[ 60  42]
[ 60  52]
[ 60  47]
[ 60  50]
[ 61  42]
[ 61  49]
[ 62  41]
[ 62  48]
[ 62  59]
[ 62  55]
[ 62  56]
[ 62  42]
[ 63  50]
[ 63  46]
[ 63  43]
[ 63  48]
```

```
[ 63  52]
[ 63  54]
[ 64  42]
[ 64  46]
[ 65  48]
[ 65  50]
[ 65  43]
[ 65  59]
[ 67  43]
[ 67  57]
[ 67  56]
[ 67  40]
[ 69  58]
[ 69  91]
[ 70  29]
[ 70  77]
[ 71  35]
[ 71  95]
[ 71  11]
[ 71  75]
[ 71   9]
[ 71  75]
[ 72  34]
[ 72  71]
[ 73   5]
[ 73  88]
[ 73   7]
[ 73  73]
[ 74  10]
[ 74  72]
[ 75   5]
[ 75  93]
[ 76  40]
[ 76  87]
[ 77  12]
[ 77  97]
[ 77  36]
[ 77  74]
[ 78  22]
[ 78  90]
[ 78  17]
[ 78  88]
[ 78  20]
[ 78  76]
[ 78  16]
[ 78  89]
[ 78   1]
[ 78  78]
[ 78   1]
[ 78  73]
[ 79  35]
[ 79  83]
[ 81   5]
[ 81  93]
[ 85  26]
[ 85  75]
[ 86  20]
[ 86  95]
[ 87  27]
[ 87  63]
[ 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]]
```

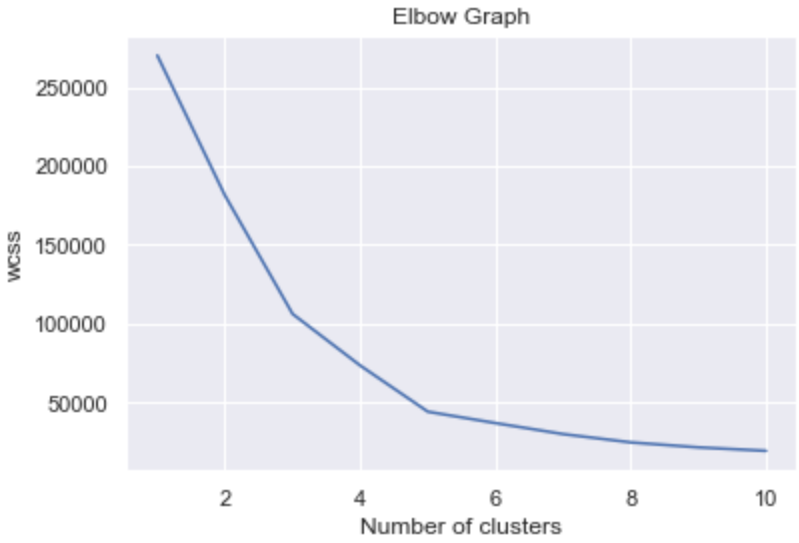
In [40]:

```
#choosing the no.of clusters using WCSS-within cluster sum of squares
#finding wcss value for different no.of clusters
wcss=[]
for i in range(1,11):
  kmeans=KMeans(n_clusters=i,init='k-means++',random_state=42)
  kmeans.fit(x)
  wcss.append(kmeans.inertia_)
```

```
C:\Users\dnhac\anaconda3\lib\site-packages\sklearn\cluster\_kmeans.py:881: UserWarning: KM
eans is known to have a memory leak on Windows with MKL, when there are less chunks than a
vailable threads. You can avoid it by setting the environment variable OMP_NUM_THREADS=1.
  warnings.warn(
```

In [41]:

```
#plotting elbow graph
sns.set()
plt.plot(range(1,11),wcss)
plt.title('Elbow Graph')
plt.xlabel('Number of clusters')
plt.ylabel('wcss')
plt.show()
```



In [42]:

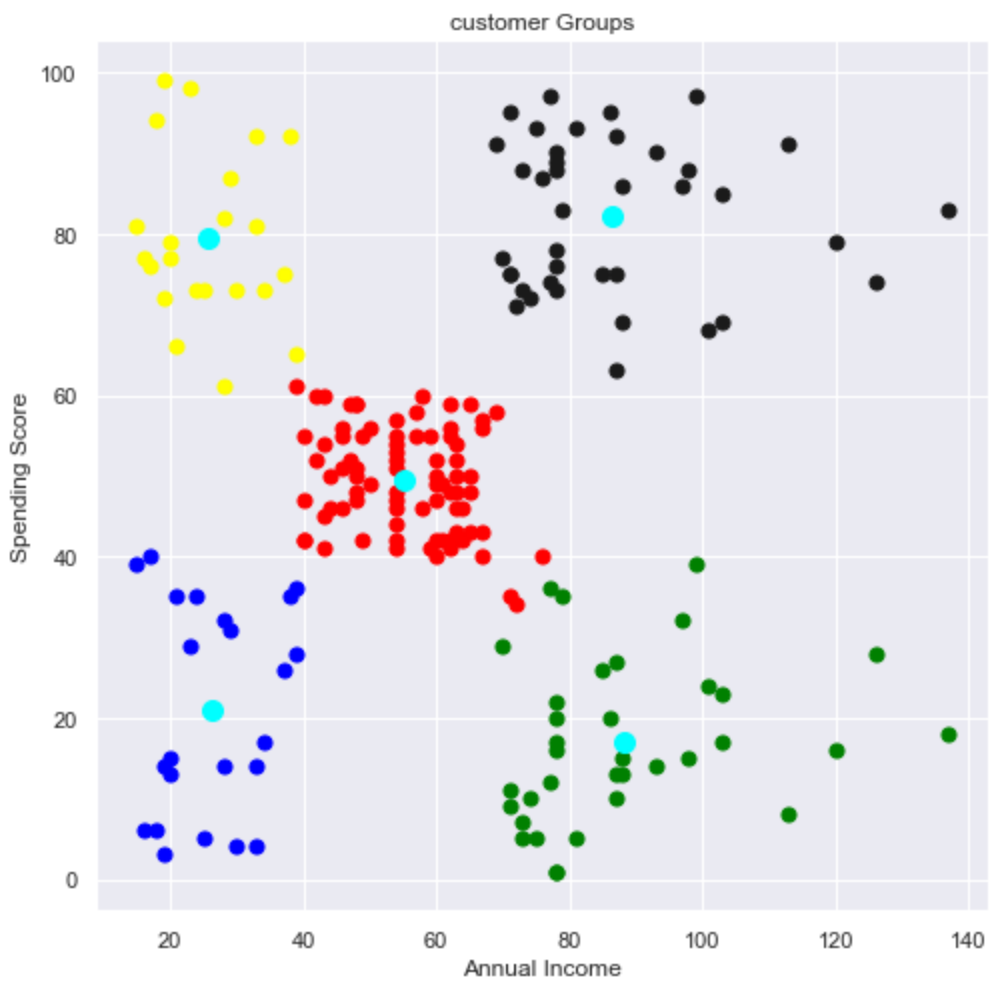
```
'''Taking clusters=5
Traing the k-means clustering model'''
kmeans=KMeans(n_clusters=5,init='k-means++',random_state=0)

# return a label for each data point based on their cluster
y=kmeans.fit_predict(x)
print(y)
```

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

In [43]:

```
#visualizing the cluster
#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='k',label='Cluster 3')
plt.scatter(x[y==3,0],x[y==3,1],s=50,c='yellow',label='Cluster 4')
plt.scatter(x[y==4,0],x[y==4,1],s=50,c='blue',label='Cluster 5')
plt.scatter(kmeans.cluster_centers_[:,0],kmeans.cluster_centers_[:,1],s=100,c='cyan',label
plt.title('customer Groups')
plt.xlabel('Annual Income')
plt.ylabel('Spending Score')
plt.show()
```



In [44]:
```
kmeans.predict([[15,39]])
#there for 5th cluster as it gave array([4])
```

Out[44]:
```
array([4])
```

In [45]:
```
#saving the Model
import joblib
joblib.dump(kmeans,"customer_segmentation")
model=joblib.load("customer_segmentation")
model.predict([[15,39]])
```

Out[45]:
```
array([4])
```

In [46]:
```
#Creating GUI
from tkinter import *
import joblib
```

In [47]:
```
import tkinter as tk
```

In [49]:
```
def show_entry_fields():
    p1=int(e1.get())
    p2=int(e2.get())

    model = joblib.load('customer_segmentation')
    result=model.predict([[p1,p2]])
    print("This Customer belongs to cluster no: ", result[0])
```

```
    if result[0] == 0:
        Label(master, text="Customers with medium annual income and medium annual spend").
    elif result[0]==1:
        Label(master, text="Customers with high annual income but low annual spend").grid(
    elif result[0]==2:
        Label(master, text="Customers with low annual income and low annual spend").grid(r
    elif result[0]==3:
        Label(master, text="Customers low annual income but high annual spend").grid(row=3
    elif result[0]==4:
        Label(master, text="Customers with high annual income and high annual spend").grid

master=Tk()
master.title("Customer Segmentation Using Machine Learning")


label = Label(master, text = "Customer Segmentation Using Machine Learning"
                          , bg = "black", fg = "white"). \
                             grid(row=0,columnspan=2)

Label(master,text="Annual Income").grid(row=1)
Label(master, text="Spending Score").grid(row=2)


e1 = Entry(master)
e2 = Entry(master)

e1.grid(row=1, column=1)
e2.grid(row=2, column=1)

Button(master, text='Predict', command=show_entry_fields).grid()

master.mainloop()
```

```
This Customer belongs to cluster no:  0
```

In [ ]: