```
import pandas as pd
```

```
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).
```

```
data=pd.read_csv('/content/drive/MyDrive/Mall_Customers.csv')
```

```
data.tail()
```

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

```
data.shape
```

```
(200, 5)
```

```
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
```

```
data.isnull().sum()
```

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

```
data.describe()
```

	CustomerID	Age	Annual Income (k$)	Spending Score (1-100)
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

Kmean Clustering

```
data.columns
```

```
Index(['CustomerID', 'Gender', 'Age', 'Annual Income (k$)',
       'Spending Score (1-100)'],
      dtype='object')
```

```
x=data[{'Annual Income (k$)','Spending Score (1-100)'}]
```

```
<ipython-input-14-368ec8eb8f7a>:1: FutureWarning: Passing a set as an indexer is deprecated and will raise in a future version. Use a li
  x=data[{'Annual Income (k$)','Spending Score (1-100)'}]
```

```
from sklearn.cluster import KMeans
```

```
k_means=KMeans()
k_means.fit(x)
```

```
/local/lib/python3.10/dist-packages/sklearn/cluster/_kmeans.py:870: FutureWarning: The de
rnings.warn(
eans
ns()
```

```
k_means=KMeans(n_clusters=5)
k_means.fit_predict(x)
```

```
/usr/local/lib/python3.10/dist-packages/sklearn/cluster/_kmeans.py:870: FutureWarning: The default value of `n_init` will change from 10
  warnings.warn(
array([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, 2,
       4, 3, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2,
       2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2,
       2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2,
       2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 1, 0, 1, 2, 1, 0, 1, 0, 1,
       2, 1, 0, 1, 0, 1, 0, 1, 0, 1, 2, 1, 0, 1, 0, 1, 0, 1, 0, 1, 0, 1,
       0, 1, 0, 1, 0, 1, 0, 1, 0, 1, 0, 1, 0, 1, 0, 1, 0, 1, 0, 1, 0, 1,
       0, 1, 0, 1, 0, 1, 0, 1, 0, 1, 0, 1, 0, 1, 0, 1, 0, 1, 0, 1, 0, 1,
       0, 1], dtype=int32)
```

Elbow Method to find optimal number of Clusters

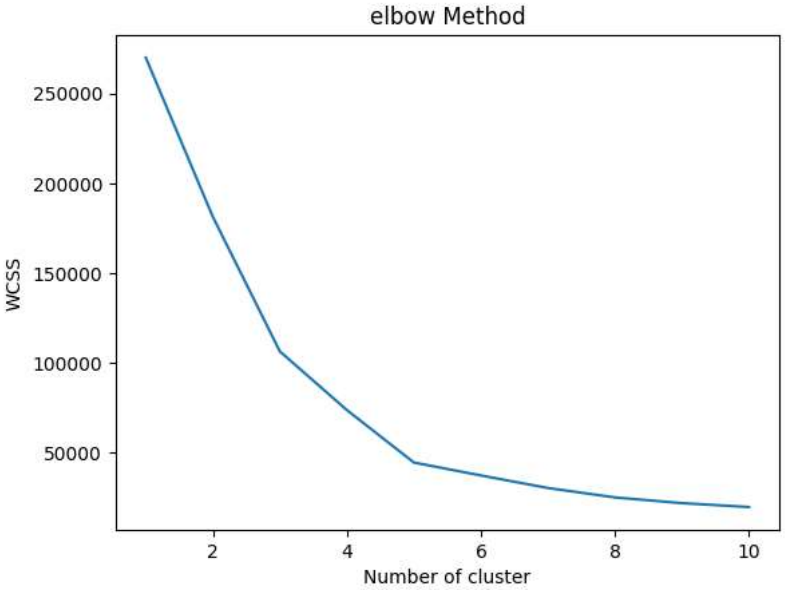
```
wcss=[]
for i in range(1,11):
  k_means=KMeans(n_clusters=i)
  k_means.fit(x)
  wcss.append(k_means.inertia_)
```

```
/usr/local/lib/python3.10/dist-packages/sklearn/cluster/_kmeans.py:870: FutureWarning: The default value of `n_init` will change from 10
  warnings.warn(
/usr/local/lib/python3.10/dist-packages/sklearn/cluster/_kmeans.py:870: FutureWarning: The default value of `n_init` will change from 10
  warnings.warn(
/usr/local/lib/python3.10/dist-packages/sklearn/cluster/_kmeans.py:870: FutureWarning: The default value of `n_init` will change from 10
  warnings.warn(
/usr/local/lib/python3.10/dist-packages/sklearn/cluster/_kmeans.py:870: FutureWarning: The default value of `n_init` will change from 10
  warnings.warn(
/usr/local/lib/python3.10/dist-packages/sklearn/cluster/_kmeans.py:870: FutureWarning: The default value of `n_init` will change from 10
  warnings.warn(
/usr/local/lib/python3.10/dist-packages/sklearn/cluster/_kmeans.py:870: FutureWarning: The default value of `n_init` will change from 10
  warnings.warn(
/usr/local/lib/python3.10/dist-packages/sklearn/cluster/_kmeans.py:870: FutureWarning: The default value of `n_init` will change from 10
  warnings.warn(
/usr/local/lib/python3.10/dist-packages/sklearn/cluster/_kmeans.py:870: FutureWarning: The default value of `n_init` will change from 10
  warnings.warn(
/usr/local/lib/python3.10/dist-packages/sklearn/cluster/_kmeans.py:870: FutureWarning: The default value of `n_init` will change from 10
  warnings.warn(
/usr/local/lib/python3.10/dist-packages/sklearn/cluster/_kmeans.py:870: FutureWarning: The default value of `n_init` will change from 10
  warnings.warn(
```

```
wcss
```

```
[269981.28,
 181363.59595959593,
 106348.37306211122,
 73679.78903948836,
 44448.4554479337,
 37233.814510710006,
 30241.34361793658,
 24995.96978113596,
 21818.114588452176,
 19646.482018947238]
```

```
import matplotlib.pyplot as plt
plt.plot(range(1,11),wcss)
plt.title("elbow Method")
plt.xlabel("Number of cluster")
plt.ylabel("WCSS")
plt.show()
```



Model Training

```
x=data[{'Annual Income (k$)','Spending Score (1-100)'}]
```

```
<ipython-input-21-368ec8eb8f7a>:1: FutureWarning: Passing a set as an indexer is deprecated and will raise in a future version. Use a li
  x=data[{'Annual Income (k$)','Spending Score (1-100)'}]
```

```
x
```

	Spending Score (1-100)	Annual Income (k$)
0	39	15
1	81	15
2	6	16
3	77	16
4	40	17
...	...	...
195	79	120
196	28	126
197	74	126
198	18	137
199	83	137

200 rows × 2 columns

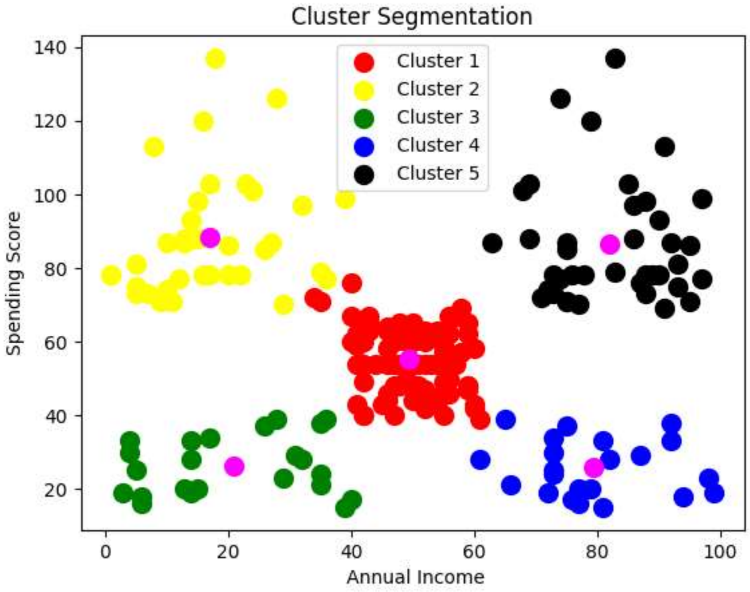
```
k_means=KMeans(n_clusters=5,random_state=42)
y_means=k_means.fit_predict(x)
```

```
/usr/local/lib/python3.10/dist-packages/sklearn/cluster/_kmeans.py:870: FutureWarning: The default value of `n_init` will change from 10
  warnings.warn(
```

```
y_means
```

```
array([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, 0,
       2, 3, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 1, 4, 0, 4, 1, 4, 1, 4,
       0, 4, 1, 4, 1, 4, 1, 4, 1, 4, 0, 4, 1, 4, 1, 4, 1, 4, 1, 4, 1, 4,
       1, 4, 1, 4, 1, 4, 1, 4, 1, 4, 1, 4, 1, 4, 1, 4, 1, 4, 1, 4, 1, 4,
       1, 4, 1, 4, 1, 4, 1, 4, 1, 4, 1, 4, 1, 4, 1, 4, 1, 4, 1, 4, 1, 4,
       1, 4], dtype=int32)
```

```
plt.scatter(x.iloc[y_means==0,0],x.iloc[y_means==0,1],s=100,c='red',label="Cluster 1")
plt.scatter(x.iloc[y_means==1,0],x.iloc[y_means==1,1],s=100,c='yellow',label="Cluster 2")
plt.scatter(x.iloc[y_means==2,0],x.iloc[y_means==2,1],s=100,c='green',label="Cluster 3")
plt.scatter(x.iloc[y_means==3,0],x.iloc[y_means==3,1],s=100,c='blue',label="Cluster 4")
plt.scatter(x.iloc[y_means==4,0],x.iloc[y_means==4,1],s=100,c='black',label="Cluster 5")
plt.scatter(k_means.cluster_centers_[:,0],k_means.cluster_centers_[:,1],s=100,c='magenta')
plt.title("Cluster Segmentation")
plt.xlabel(" Annual Income")
plt.ylabel("Spending Score")
plt.legend()
plt.show()
```



```
k_means.predict([[13,70]])
```

```
/usr/local/lib/python3.10/dist-packages/sklearn/base.py:439: UserWarning: X does not have valid feature names, but KMeans was fitted wit
  warnings.warn(
array([1], dtype=int32)
```

Save the Model

```
import joblib
```

```
joblib.dump(k_means,"customer_segmentation")
```

```
['customer_segmentation']
```

```
model=joblib.load("customer_segmentation")
```

```
model.predict([[15,39]])
```

```
/usr/local/lib/python3.10/dist-packages/sklearn/base.py:439: UserWarning: X does not have valid feature names, but KMeans was fitted wit
  warnings.warn(
array([2], dtype=int32)
```