UNSUPERVISED MACHINE LEARNING

Import required libraries

In [ ]:

```
import numpy as np
import pandas as pd
df=pd.read_csv('/content/Mall_Customers.csv')
df
```

Out[ ]:

	CustomerID	Genre	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
...	...	...	...	...	...
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 [ ]:

```
df.head()
```

Out[ ]:

	CustomerID	Genre	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 [ ]:

```
df.tail()
```

Out[ ]:

	CustomerID	Genre	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

In [ ]:

```
df.dtypes
```

Out[ ]:

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

In [ ]:

```
df.columns
```

Out[ ]:

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

Checking missing values

In [ ]:

```
df.isna().sum()
```

Out[ ]:

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

Encoding using LabelEncoder

In [ ]:

```
from sklearn.preprocessing import LabelEncoder
le=LabelEncoder()
df['Genre']=le.fit_transform(df['Genre'])
```

Feature selection

In [ ]:

```
x=df.iloc[:,1:]
x.ndim
x
```

Out[ ]:

	Genre	Age	Annual Income (k$)	Spending Score (1-100)
0	1	19	15	39
1	1	21	15	81
2	0	20	16	6
3	0	23	16	77
4	0	31	17	40
...	...	...	...	...
195	0	35	120	79
196	0	45	126	28
197	1	32	126	74
198	1	32	137	18
199	1	30	137	83

200 rows × 4 columns

Cluster identification

In [ ]:

```
from sklearn.cluster import KMeans
wcss=[]
for i in range(1,11):
  model=KMeans(n_clusters=i,init='k-means++',random_state=42)
  model.fit(x)
  wcss.append(model.inertia_)
```

```
/usr/local/lib/python3.10/dist-packages/sklearn/cluster/_kmeans.py:870: FutureWarning: The default value of `n_init` will change from 10 to 'auto' in 1.4. Set the value of `n_init` explicitly to suppress the w
arning
  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 to 'auto' in 1.4. Set the value of `n_init` explicitly to suppress the w
arning
  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 to 'auto' in 1.4. Set the value of `n_init` explicitly to suppress the w
arning
  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 to 'auto' in 1.4. Set the value of `n_init` explicitly to suppress the w
arning
  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 to 'auto' in 1.4. Set the value of `n_init` explicitly to suppress the w
arning
  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 to 'auto' in 1.4. Set the value of `n_init` explicitly to suppress the w
arning
  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 to 'auto' in 1.4. Set the value of `n_init` explicitly to suppress the w
arning
  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 to 'auto' in 1.4. Set the value of `n_init` explicitly to suppress the w
arning
  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 to 'auto' in 1.4. Set the value of `n_init` explicitly to suppress the w
arning
  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 to 'auto' in 1.4. Set the value of `n_init` explicitly to suppress the w
arning
  warnings.warn(
```

In [ ]:

```
print(wcss)
```

```
[308862.06000000006, 212889.44245524303, 143391.59236035676, 104414.67534220168, 75427.71182424155, 58348.641363315044, 51575.2779310779, 44359.634641148325, 40942.51117006117, 37515.84125504126]
```

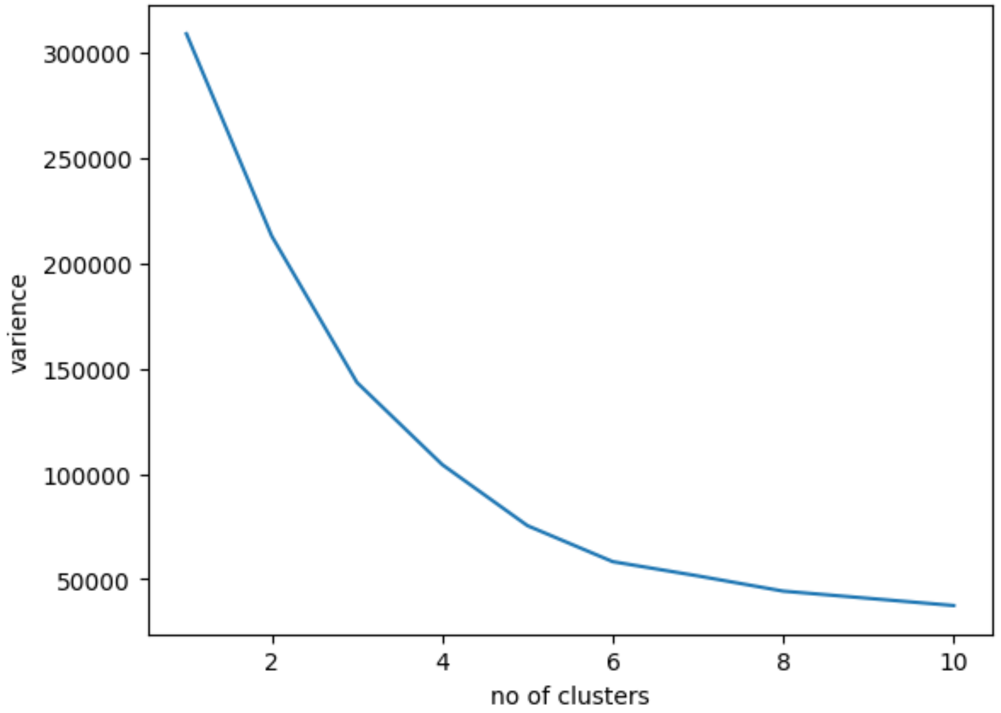
Elbow points

In [ ]:

```
import matplotlib.pyplot as plt
plt.plot(range(1,11),wcss)
plt.xlabel('no of clusters')
plt.ylabel('varience')
```

Out[ ]:

```
Text(0, 0.5, 'varience')
```



```
In [ ]: model1=KMeans(n_clusters=6,init='k-means++',random_state=42)
        y_means=model1.fit_predict(x)
        y_means
```

```
/usr/local/lib/python3.10/dist-packages/sklearn/cluster/_kmeans.py:870: FutureWarning: The default value of `n_init` will change from 10 to 'auto' in 1.4. Set the value of `n_init` explicitly to suppress the w
arning
  warnings.warn(
```

```
Out[ ]: array([5, 2, 5, 2, 5, 2, 5, 2, 5, 2, 5, 2, 5, 2, 5, 2, 5, 2, 5, 2, 5, 2,
               5, 2, 5, 2, 5, 2, 5, 2, 5, 2, 5, 2, 5, 2, 5, 2, 5, 2, 1, 2, 1, 4,
               5, 2, 1, 4, 4, 4, 1, 4, 4, 1, 1, 1, 1, 1, 4, 1, 1, 4, 1, 1, 1, 4,
               1, 1, 4, 4, 1, 1, 1, 1, 1, 4, 1, 4, 4, 1, 1, 4, 1, 1, 4, 1, 1, 4,
               4, 1, 1, 4, 1, 4, 4, 4, 1, 4, 1, 4, 4, 1, 1, 4, 1, 4, 1, 1, 1, 1,
               1, 4, 4, 4, 4, 4, 1, 1, 1, 1, 4, 4, 4, 0, 4, 0, 3, 0, 3, 0, 3, 0,
               4, 0, 3, 0, 3, 0, 3, 0, 3, 0, 4, 0, 3, 0, 3, 0, 3, 0, 3, 0, 3, 0,
               3, 0, 3, 0, 3, 0, 3, 0, 3, 0, 3, 0, 3, 0, 3, 0, 3, 0, 3, 0, 3, 0,
               3, 0, 3, 0, 3, 0, 3, 0, 3, 0, 3, 0, 3, 0, 3, 0, 3, 0, 3, 0, 3, 0,
               3, 0], dtype=int32)
```

```
In [ ]: x['Cluster']=y_means
        x
```

Out[ ]:

	Genre	Age	Annual Income (k$)	Spending Score (1-100)	Cluster
0	1	19	15	39	5
1	1	21	15	81	2
2	0	20	16	6	5
3	0	23	16	77	2
4	0	31	17	40	5
...	...	...	...	...	...
195	0	35	120	79	0
196	0	45	126	28	3
197	1	32	126	74	0
198	1	32	137	18	3
199	1	30	137	83	0

200 rows × 5 columns

Data seperation

```
In [ ]: x1=x.iloc[:,:-1]
        x1
```

Out[ ]:

	Genre	Age	Annual Income (k$)	Spending Score (1-100)
0	1	19	15	39
1	1	21	15	81
2	0	20	16	6
3	0	23	16	77
4	0	31	17	40
...	...	...	...	...
195	0	35	120	79
196	0	45	126	28
197	1	32	126	74
198	1	32	137	18
199	1	30	137	83

200 rows × 4 columns

In [ ]:

```
y1=x.iloc[:,-1]
y1
```

Out[ ]:

```
0      5
1      2
2      5
3      2
4      5
      ..
195    0
196    3
197    0
198    3
199    0
Name: Cluster, Length: 200, dtype: int32
```

Split the data into Training & Testing data

In [ ]:

```
from sklearn.model_selection import train_test_split
x_train,x_test,y_train,y_test=train_test_split(x1,y1,test_size=0.30,random_state=42)
x_train
```

Out[ ]:

	Genre	Age	Annual Income (k$)	Spending Score (1-100)
169	1	32	87	63
97	0	27	60	50
31	0	21	30	73
12	0	58	20	15
35	0	21	33	81
...	...	...	...	...
106	0	66	63	50
14	1	37	20	13
92	1	48	60	49
179	1	35	93	90
102	1	67	62	59

140 rows × 4 columns

```
In [ ]: x_test
        y_train
        y_test
```

```
Out[ ]: 95     4
        15     2
        30     5
        158    3
        128    3
        115    4
        69     4
        170    3
        174    3
        45     2
        66     1
        182    3
        165    0
        78     4
        186    3
        177    0
        56     1
        152    3
        82     1
        68     4
        124    4
        16     5
        148    3
        93     4
        65     4
        60     1
        84     4
        67     1
        125    0
        132    4
        9      2
        18     5
        55     1
        75     4
        150    3
        104    1
        135    0
        137    0
        164    3
        76     1
        79     1
        197    0
        38     5
        24     5
        122    4
        195    0
        29     2
        19     2
        143    0
        86     1
        114    4
        173    0
        5      2
        126    3
        117    1
        73     1
        140    3
        98     1
        172    3
        96     1
        Name: Cluster, dtype: int32
```

Data Normalization

```
In [ ]: from sklearn.preprocessing import StandardScaler
        scaler=StandardScaler()
```

```
scaler.fit(x_train)
x_train=scaler.transform(x_train)
x_test=scaler.transform(x_test)
```

Model Creation using Knn

In [ ]:

```
from sklearn.neighbors import KNeighborsClassifier
knn=KNeighborsClassifier(n_neighbors=5)
knn.fit(x_train,y_train)
y_pred=knn.predict(x_test)
y_pred
```

Out[ ]:

```
array([4, 2, 5, 3, 3, 4, 4, 3, 3, 2, 1, 3, 0, 4, 3, 0, 1, 3, 1, 4, 4, 5,
       3, 4, 4, 1, 4, 1, 0, 4, 2, 5, 1, 4, 3, 1, 0, 0, 3, 1, 1, 0, 5, 5,
       4, 0, 2, 2, 0, 1, 4, 0, 2, 1, 1, 1, 3, 1, 3, 1], dtype=int32)
```

Performance Evaluation

In [ ]:

```
from sklearn.metrics import confusion_matrix,accuracy_score
matr=confusion_matrix(y_test,y_pred)
matr
score=accuracy_score(y_test,y_pred)
score
```

Out[ ]:

```
0.9833333333333333
```

In [ ]: