p229278

March 28, 2024

1 Muhammad Shafeen

2 22P-9278

3 BS-AI-4A

4 Task 8

4.1 Import Libraries

[ ]:
```
from sklearn.cluster import KMeans
from sklearn.preprocessing import StandardScaler
from sklearn.preprocessing import Normalizer
import sklearn as sk
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
```

4.2 Cleaning Data

[ ]:
```
path="/home/shafeenkhan/Documents/My-all-programs--/Semester-4/Aritificial␣
  ↪Intelligence/LAB-09/Mall_Customers.csv"
df=pd.read_csv(path)
df.isna().sum()
# df=df.ffill()
df
```

[ ]:

	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
..	…	…	…	…	…
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 x 5 columns]
```

[ ]:
```
df
```

[ ]:
```
     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
..          …     …  …                   …                       …
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 x 5 columns]
```

4.3 Normalization

[ ]:
```
df["Gender"]=df["Gender"].map({"Male":0,"Female":1})
df2=df
df2.drop(columns=["CustomerID"])
scaler=StandardScaler()
df2=scaler.fit_transform(df)
df2
```

[ ]:
```
array([[-1.7234121 , -1.12815215, -1.42456879, -1.73899919, -0.43480148],
       [-1.70609137, -1.12815215, -1.28103541, -1.73899919,  1.19570407],
       [-1.68877065,  0.88640526, -1.3528021 , -1.70082976, -1.71591298],
       [-1.67144992,  0.88640526, -1.13750203, -1.70082976,  1.04041783],
       [-1.6541292 ,  0.88640526, -0.56336851, -1.66266033, -0.39597992],
       [-1.63680847,  0.88640526, -1.20926872, -1.66266033,  1.00159627],
       [-1.61948775,  0.88640526, -0.27630176, -1.62449091, -1.71591298],
       [-1.60216702,  0.88640526, -1.13750203, -1.62449091,  1.70038436],
       [-1.5848463 , -1.12815215,  1.80493225, -1.58632148, -1.83237767],
       [-1.56752558,  0.88640526, -0.6351352 , -1.58632148,  0.84631002],
       [-1.55020485, -1.12815215,  2.02023231, -1.58632148, -1.4053405 ],
       [-1.53288413,  0.88640526, -0.27630176, -1.58632148,  1.89449216],
       [-1.5155634 ,  0.88640526,  1.37433211, -1.54815205, -1.36651894],
       [-1.49824268,  0.88640526, -1.06573534, -1.54815205,  1.04041783],
       [-1.48092195, -1.12815215, -0.13276838, -1.54815205, -1.44416206],
       [-1.46360123, -1.12815215, -1.20926872, -1.54815205,  1.11806095],
```

```
[-1.4462805 ,  0.88640526, -0.27630176, -1.50998262, -0.59008772],
[-1.42895978, -1.12815215, -1.3528021 , -1.50998262,  0.61338066],
[-1.41163905, -1.12815215,  0.94373197, -1.43364376, -0.82301709],
[-1.39431833,  0.88640526, -0.27630176, -1.43364376,  1.8556706 ],
[-1.3769976 , -1.12815215, -0.27630176, -1.39547433, -0.59008772],
[-1.35967688, -1.12815215, -0.99396865, -1.39547433,  0.88513158],
[-1.34235616,  0.88640526,  0.51313183, -1.3573049 , -1.75473454],
[-1.32503543, -1.12815215, -0.56336851, -1.3573049 ,  0.88513158],
[-1.30771471,  0.88640526,  1.08726535, -1.24279661, -1.4053405 ],
[-1.29039398, -1.12815215, -0.70690189, -1.24279661,  1.23452563],
[-1.27307326,  0.88640526,  0.44136514, -1.24279661, -0.7065524 ],
[-1.25575253, -1.12815215, -0.27630176, -1.24279661,  0.41927286],
[-1.23843181,  0.88640526,  0.08253169, -1.20462718, -0.74537397],
[-1.22111108,  0.88640526, -1.13750203, -1.20462718,  1.42863343],
[-1.20379036, -1.12815215,  1.51786549, -1.16645776, -1.7935561 ],
[-1.18646963,  0.88640526, -1.28103541, -1.16645776,  0.88513158],
[-1.16914891, -1.12815215,  1.01549866, -1.05194947, -1.7935561 ],
[-1.15182818, -1.12815215, -1.49633548, -1.05194947,  1.62274124],
[-1.13450746,  0.88640526,  0.7284319 , -1.05194947, -1.4053405 ],
[-1.11718674,  0.88640526, -1.28103541, -1.05194947,  1.19570407],
[-1.09986601,  0.88640526,  0.22606507, -1.01378004, -1.28887582],
[-1.08254529,  0.88640526, -0.6351352 , -1.01378004,  0.88513158],
[-1.06522456,  0.88640526, -0.20453507, -0.89927175, -0.93948177],
[-1.04790384,  0.88640526, -1.3528021 , -0.89927175,  0.96277471],
[-1.03058311,  0.88640526,  1.87669894, -0.86110232, -0.59008772],
[-1.01326239, -1.12815215, -1.06573534, -0.86110232,  1.62274124],
[-0.99594166, -1.12815215,  0.65666521, -0.82293289, -0.55126616],
[-0.97862094,  0.88640526, -0.56336851, -0.82293289,  0.41927286],
[-0.96130021,  0.88640526,  0.7284319 , -0.82293289, -0.86183865],
[-0.94397949,  0.88640526, -1.06573534, -0.82293289,  0.5745591 ],
[-0.92665877,  0.88640526,  0.80019859, -0.78476346,  0.18634349],
[-0.90933804,  0.88640526, -0.85043527, -0.78476346, -0.12422899],
[-0.89201732,  0.88640526, -0.70690189, -0.78476346, -0.3183368 ],
[-0.87469659,  0.88640526, -0.56336851, -0.78476346, -0.3183368 ],
[-0.85737587,  0.88640526,  0.7284319 , -0.70842461,  0.06987881],
[-0.84005514, -1.12815215, -0.41983513, -0.70842461,  0.38045129],
[-0.82273442,  0.88640526, -0.56336851, -0.67025518,  0.14752193],
[-0.80541369, -1.12815215,  1.4460988 , -0.67025518,  0.38045129],
[-0.78809297,  0.88640526,  0.80019859, -0.67025518, -0.20187212],
[-0.77077224, -1.12815215,  0.58489852, -0.67025518, -0.35715836],
[-0.75345152,  0.88640526,  0.87196528, -0.63208575, -0.00776431],
[-0.73613079, -1.12815215,  2.16376569, -0.63208575, -0.16305055],
[-0.71881007,  0.88640526, -0.85043527, -0.55574689,  0.03105725],
[-0.70148935, -1.12815215,  1.01549866, -0.55574689, -0.16305055],
[-0.68416862, -1.12815215,  2.23553238, -0.55574689,  0.22516505],
[-0.6668479 , -1.12815215, -1.42456879, -0.55574689,  0.18634349],
[-0.64952717,  0.88640526,  2.02023231, -0.51757746,  0.06987881],
```

```
[-0.63220645,  0.88640526,  1.08726535, -0.51757746,  0.34162973],
[-0.61488572, -1.12815215,  1.73316556, -0.47940803,  0.03105725],
[-0.597565  , -1.12815215, -1.49633548, -0.47940803,  0.34162973],
[-0.58024427,  0.88640526,  0.29783176, -0.47940803, -0.00776431],
[-0.56292355,  0.88640526,  2.091999  , -0.47940803, -0.08540743],
[-0.54560282, -1.12815215, -1.42456879, -0.47940803,  0.34162973],
[-0.5282821 ,  0.88640526, -0.49160182, -0.47940803, -0.12422899],
[-0.51096138, -1.12815215,  2.23553238, -0.4412386 ,  0.18634349],
[-0.49364065,  0.88640526,  0.58489852, -0.4412386 , -0.3183368 ],
[-0.47631993,  0.88640526,  1.51786549, -0.40306917, -0.04658587],
[-0.4589992 ,  0.88640526,  1.51786549, -0.40306917,  0.22516505],
[-0.44167848, -1.12815215,  1.4460988 , -0.25039146, -0.12422899],
[-0.42435775, -1.12815215, -0.92220196, -0.25039146,  0.14752193],
[-0.40703703,  0.88640526,  0.44136514, -0.25039146,  0.10870037],
[-0.3897163 , -1.12815215,  0.08253169, -0.25039146, -0.08540743],
[-0.37239558,  0.88640526, -1.13750203, -0.25039146,  0.06987881],
[-0.35507485,  0.88640526,  0.7284319 , -0.25039146, -0.3183368 ],
[-0.33775413, -1.12815215,  1.30256542, -0.25039146,  0.03105725],
[-0.3204334 , -1.12815215, -0.06100169, -0.25039146,  0.18634349],
[-0.30311268, -1.12815215,  2.02023231, -0.25039146, -0.35715836],
[-0.28579196,  0.88640526,  0.51313183, -0.25039146, -0.24069368],
[-0.26847123,  0.88640526, -1.28103541, -0.25039146,  0.26398661],
[-0.25115051, -1.12815215,  0.65666521, -0.25039146, -0.16305055],
[-0.23382978,  0.88640526,  1.15903204, -0.13588317,  0.30280817],
[-0.21650906,  0.88640526, -1.20926872, -0.13588317,  0.18634349],
[-0.19918833,  0.88640526, -0.34806844, -0.09771374,  0.38045129],
[-0.18186761,  0.88640526,  0.80019859, -0.09771374, -0.16305055],
[-0.16454688,  0.88640526,  2.091999  , -0.05954431,  0.18634349],
[-0.14722616, -1.12815215, -1.49633548, -0.05954431, -0.35715836],
[-0.12990543, -1.12815215,  0.65666521, -0.02137488, -0.04658587],
[-0.11258471,  0.88640526,  0.08253169, -0.02137488, -0.39597992],
[-0.09526399,  0.88640526, -0.49160182, -0.02137488, -0.3183368 ],
[-0.07794326, -1.12815215, -1.06573534, -0.02137488,  0.06987881],
[-0.06062254,  0.88640526,  0.58489852, -0.02137488, -0.12422899],
[-0.04330181,  0.88640526, -0.85043527, -0.02137488, -0.00776431],
[-0.02598109, -1.12815215,  0.65666521,  0.01679455, -0.3183368 ],
[-0.00866036, -1.12815215, -1.3528021 ,  0.01679455, -0.04658587],
[ 0.00866036,  0.88640526, -1.13750203,  0.05496398, -0.35715836],
[ 0.02598109,  0.88640526,  0.7284319 ,  0.05496398, -0.08540743],
[ 0.04330181, -1.12815215,  2.02023231,  0.05496398,  0.34162973],
[ 0.06062254, -1.12815215, -0.92220196,  0.05496398,  0.18634349],
[ 0.07794326, -1.12815215,  0.7284319 ,  0.05496398,  0.22516505],
[ 0.09526399,  0.88640526, -1.28103541,  0.05496398, -0.3183368 ],
[ 0.11258471,  0.88640526,  1.94846562,  0.09313341, -0.00776431],
[ 0.12990543, -1.12815215,  1.08726535,  0.09313341, -0.16305055],
[ 0.14722616, -1.12815215,  2.091999  ,  0.09313341, -0.27951524],
[ 0.16454688, -1.12815215,  1.94846562,  0.09313341, -0.08540743],
```

```
[ 0.18186761, -1.12815215,  1.87669894,  0.09313341,  0.06987881],
[ 0.19918833,  0.88640526, -1.42456879,  0.09313341,  0.14752193],
[ 0.21650906,  0.88640526, -0.06100169,  0.13130284, -0.3183368 ],
[ 0.23382978, -1.12815215, -1.42456879,  0.13130284, -0.16305055],
[ 0.25115051,  0.88640526, -1.49633548,  0.16947227, -0.08540743],
[ 0.26847123,  0.88640526, -1.42456879,  0.16947227, -0.00776431],
[ 0.28579196,  0.88640526,  1.73316556,  0.16947227, -0.27951524],
[ 0.30311268,  0.88640526,  0.7284319 ,  0.16947227,  0.34162973],
[ 0.3204334 ,  0.88640526,  0.87196528,  0.24581112, -0.27951524],
[ 0.33775413,  0.88640526,  0.80019859,  0.24581112,  0.26398661],
[ 0.35507485, -1.12815215, -0.85043527,  0.24581112,  0.22516505],
[ 0.37239558,  0.88640526, -0.06100169,  0.24581112, -0.39597992],
[ 0.3897163 ,  0.88640526,  0.08253169,  0.32214998,  0.30280817],
[ 0.40703703, -1.12815215,  0.010765  ,  0.32214998,  1.58391968],
[ 0.42435775,  0.88640526, -1.13750203,  0.36031941, -0.82301709],
[ 0.44167848,  0.88640526, -0.56336851,  0.36031941,  1.04041783],
[ 0.4589992 , -1.12815215,  0.29783176,  0.39848884, -0.59008772],
[ 0.47631993, -1.12815215,  0.08253169,  0.39848884,  1.73920592],
[ 0.49364065, -1.12815215,  1.4460988 ,  0.39848884, -1.52180518],
[ 0.51096138, -1.12815215, -0.06100169,  0.39848884,  0.96277471],
[ 0.5282821 , -1.12815215,  0.58489852,  0.39848884, -1.5994483 ],
[ 0.54560282, -1.12815215,  0.010765  ,  0.39848884,  0.96277471],
[ 0.56292355,  0.88640526, -0.99396865,  0.43665827, -0.62890928],
[ 0.58024427,  0.88640526, -0.56336851,  0.43665827,  0.80748846],
[ 0.597565  , -1.12815215, -1.3528021 ,  0.4748277 , -1.75473454],
[ 0.61488572,  0.88640526, -0.70690189,  0.4748277 ,  1.46745499],
[ 0.63220645,  0.88640526,  0.36959845,  0.4748277 , -1.67709142],
[ 0.64952717, -1.12815215, -0.49160182,  0.4748277 ,  0.88513158],
[ 0.6668479 , -1.12815215, -1.42456879,  0.51299713, -1.56062674],
[ 0.68416862,  0.88640526, -0.27630176,  0.51299713,  0.84631002],
[ 0.70148935,  0.88640526,  1.30256542,  0.55116656, -1.75473454],
[ 0.71881007, -1.12815215, -0.49160182,  0.55116656,  1.6615628 ],
[ 0.73613079,  0.88640526, -0.77866858,  0.58933599, -0.39597992],
[ 0.75345152,  0.88640526, -0.49160182,  0.58933599,  1.42863343],
[ 0.77077224, -1.12815215, -0.99396865,  0.62750542, -1.48298362],
[ 0.78809297, -1.12815215, -0.77866858,  0.62750542,  1.81684904],
[ 0.80541369, -1.12815215,  0.65666521,  0.62750542, -0.55126616],
[ 0.82273442,  0.88640526, -0.49160182,  0.62750542,  0.92395314],
[ 0.84005514,  0.88640526, -0.34806844,  0.66567484, -1.09476801],
[ 0.85737587, -1.12815215, -0.34806844,  0.66567484,  1.54509812],
[ 0.87469659, -1.12815215,  0.29783176,  0.66567484, -1.28887582],
[ 0.89201732, -1.12815215,  0.010765  ,  0.66567484,  1.46745499],
[ 0.90933804,  0.88640526,  0.36959845,  0.66567484, -1.17241113],
[ 0.92665877,  0.88640526, -0.06100169,  0.66567484,  1.00159627],
[ 0.94397949,  0.88640526,  0.58489852,  0.66567484, -1.32769738],
[ 0.96130021,  0.88640526, -0.85043527,  0.66567484,  1.50627656],
[ 0.97862094, -1.12815215, -0.13276838,  0.66567484, -1.91002079],
```

```
[ 0.99594166,  0.88640526, -0.6351352 ,  0.66567484,  1.07923939],
[ 1.01326239, -1.12815215, -0.34806844,  0.66567484, -1.91002079],
[ 1.03058311,  0.88640526, -0.6351352 ,  0.66567484,  0.88513158],
[ 1.04790384,  0.88640526,  1.23079873,  0.70384427, -0.59008772],
[ 1.06522456,  0.88640526, -0.70690189,  0.70384427,  1.27334719],
[ 1.08254529, -1.12815215, -1.42456879,  0.78018313, -1.75473454],
[ 1.09986601,  0.88640526, -0.56336851,  0.78018313,  1.6615628 ],
[ 1.11718674, -1.12815215,  0.80019859,  0.93286085, -0.93948177],
[ 1.13450746,  0.88640526, -0.20453507,  0.93286085,  0.96277471],
[ 1.15182818, -1.12815215,  0.22606507,  0.97103028, -1.17241113],
[ 1.16914891,  0.88640526, -0.41983513,  0.97103028,  1.73920592],
[ 1.18646963,  0.88640526, -0.20453507,  1.00919971, -0.90066021],
[ 1.20379036, -1.12815215, -0.49160182,  1.00919971,  0.49691598],
[ 1.22111108, -1.12815215,  0.08253169,  1.00919971, -1.44416206],
[ 1.23843181, -1.12815215, -0.77866858,  1.00919971,  0.96277471],
[ 1.25575253, -1.12815215, -0.20453507,  1.00919971, -1.56062674],
[ 1.27307326, -1.12815215, -0.20453507,  1.00919971,  1.62274124],
[ 1.29039398,  0.88640526,  0.94373197,  1.04736914, -1.44416206],
[ 1.30771471,  0.88640526, -0.6351352 ,  1.04736914,  1.38981187],
[ 1.32503543, -1.12815215,  1.37433211,  1.04736914, -1.36651894],
[ 1.34235616, -1.12815215, -0.85043527,  1.04736914,  0.72984534],
[ 1.35967688, -1.12815215,  1.4460988 ,  1.23821628, -1.4053405 ],
[ 1.3769976 , -1.12815215, -0.27630176,  1.23821628,  1.54509812],
[ 1.39431833,  0.88640526, -0.13276838,  1.390894  , -0.7065524 ],
[ 1.41163905,  0.88640526, -0.49160182,  1.390894  ,  1.38981187],
[ 1.42895978, -1.12815215,  0.51313183,  1.42906343, -1.36651894],
[ 1.4462805 ,  0.88640526, -0.70690189,  1.42906343,  1.46745499],
[ 1.46360123,  0.88640526,  0.15429838,  1.46723286, -0.43480148],
[ 1.48092195, -1.12815215, -0.6351352 ,  1.46723286,  1.81684904],
[ 1.49824268,  0.88640526,  1.08726535,  1.54357172, -1.01712489],
[ 1.5155634 , -1.12815215, -0.77866858,  1.54357172,  0.69102378],
[ 1.53288413,  0.88640526,  0.15429838,  1.61991057, -1.28887582],
[ 1.55020485,  0.88640526, -0.20453507,  1.61991057,  1.35099031],
[ 1.56752558,  0.88640526, -0.34806844,  1.61991057, -1.05594645],
[ 1.5848463 ,  0.88640526, -0.49160182,  1.61991057,  0.72984534],
[ 1.60216702, -1.12815215, -0.41983513,  2.00160487, -1.63826986],
[ 1.61948775,  0.88640526, -0.06100169,  2.00160487,  1.58391968],
[ 1.63680847,  0.88640526,  0.58489852,  2.26879087, -1.32769738],
[ 1.6541292 ,  0.88640526, -0.27630176,  2.26879087,  1.11806095],
[ 1.67144992,  0.88640526,  0.44136514,  2.49780745, -0.86183865],
[ 1.68877065, -1.12815215, -0.49160182,  2.49780745,  0.92395314],
[ 1.70609137, -1.12815215, -0.49160182,  2.91767117, -1.25005425],
[ 1.7234121 , -1.12815215, -0.6351352 ,  2.91767117,  1.27334719]])
```

[ ]:
```
# Specifying the number of clusters
kmeans = KMeans(n_clusters=3,n_init=10)
```

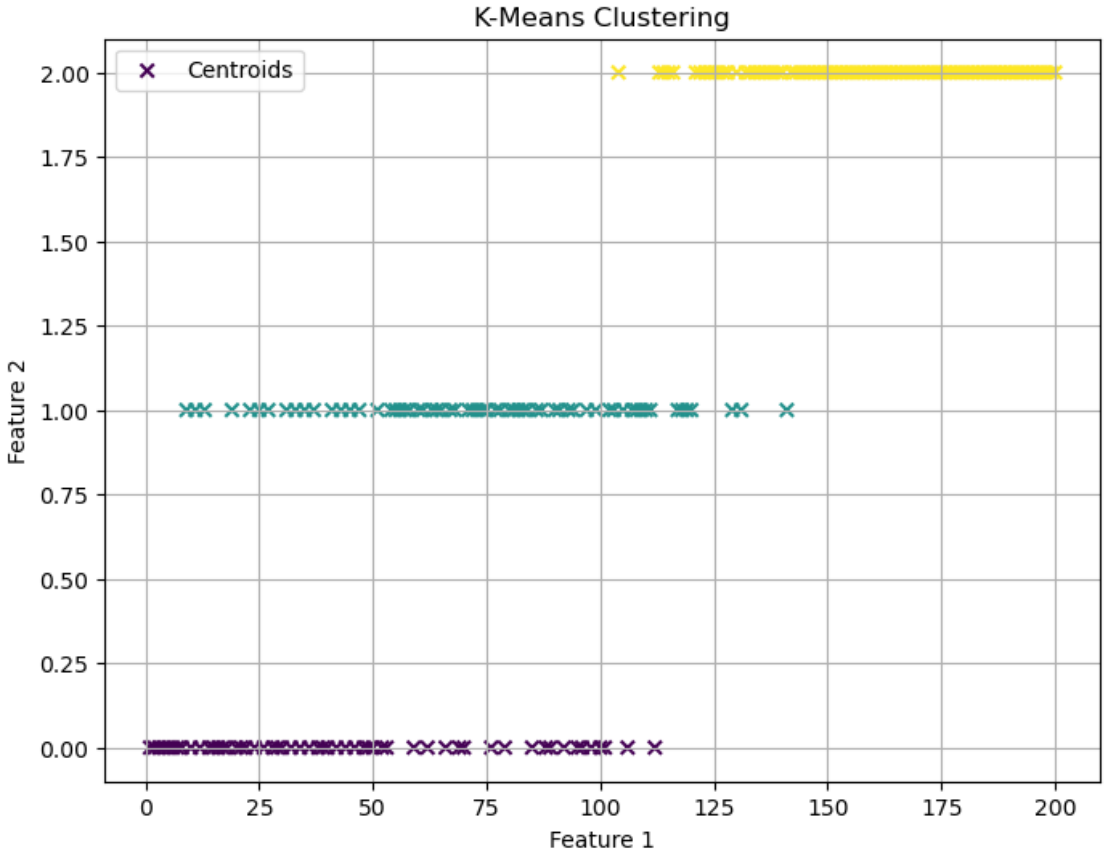
```
# Fitting the model to the data
kmeans.fit(df2)

# Getting the centroids of the clusters
centroids = kmeans.cluster_centers_
print("Centroids:")
print(centroids)

# Getting the labels assigned to each data point
labels = kmeans.labels_
print("\nLabels:")
print(labels)
```

```
Centroids:
[[-0.95846591  0.15383893 -0.89480014 -0.91870346  0.31198418]
 [-0.47192101 -0.04093069  1.13852727 -0.42245682 -0.37379617]
 [ 1.00544694 -0.0717379  -0.27455135  0.94077402  0.07792718]]

Labels:
[0 0 0 0 0 0 0 0 1 0 1 0 1 0 0 0 0 0 1 0 0 0 1 0 1 0 1 0 0 0 1 0 1 0 1 0 1
 0 0 0 1 0 1 0 1 0 1 0 0 0 1 0 0 1 1 1 1 1 0 1 1 0 1 1 1 0 1 1 0 0 1 1 1 1
 1 0 1 1 0 1 1 1 1 1 0 1 1 0 0 1 1 0 1 1 0 0 1 0 1 0 0 1 1 2 1 0 1 1 1 1 1
 0 2 2 2 2 1 1 1 1 2 2 2 2 2 2 2 2 1 2 1 2 2 2 2 2 2 2 2 2 1 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]
```

[ ]:
```
# plt.scatter(np.array(labels),df)
```

[ ]:
```
# Plotting
plt.figure(figsize=(8, 6))

# Scatter plot of data points colored by labels
plt.scatter(df["CustomerID"],labels ,c=labels , marker='x', label='Centroids')
# plt.scatter(centroids[:, 0], centroids[:, 1], c='red', marker='o',␣
 ↪edgecolor='black', s=100)  # Ensure markers are visible

# plt.scatter(centroids[:, 0], centroids[:, 1], c='blue', marker='x',␣
 ↪label='Centroids')
# plt.scatter(centroids[:, 0], centroids[:, 1], c='blue', marker='o',␣
 ↪edgecolor='black', s=100)  # Ensure markers are visible
#
# plt.scatter(centroids[:, 0], centroids[:, 1], c='green', marker='x',␣
 ↪label='Centroids')
# plt.scatter(centroids[:, 0], centroids[:, 1], c='green', marker='o',␣
 ↪edgecolor='black', s=100)  # Ensure markers are visible

plt.xlabel('Feature 1')
```

```
plt.ylabel('Feature 2')
plt.title('K-Means Clustering')

plt.legend()
plt.grid(True)
plt.show()
```



5 Question 2

[ ]:
```
sse = []
for k in range(1, 100):
    kmeans = KMeans(n_clusters=k, max_iter=300, random_state=0)
    kmeans.fit(df)
    sse.append(kmeans.inertia_)

number_clusters = range(1,100)
plt.plot(number_clusters, sse)
plt.title('Elbow Method')
plt.xlabel('Number of Clusters')
```

```python
plt.ylabel('SSE')
plt.show()
```

```
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
```

```
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
```

```
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
```

```
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
```

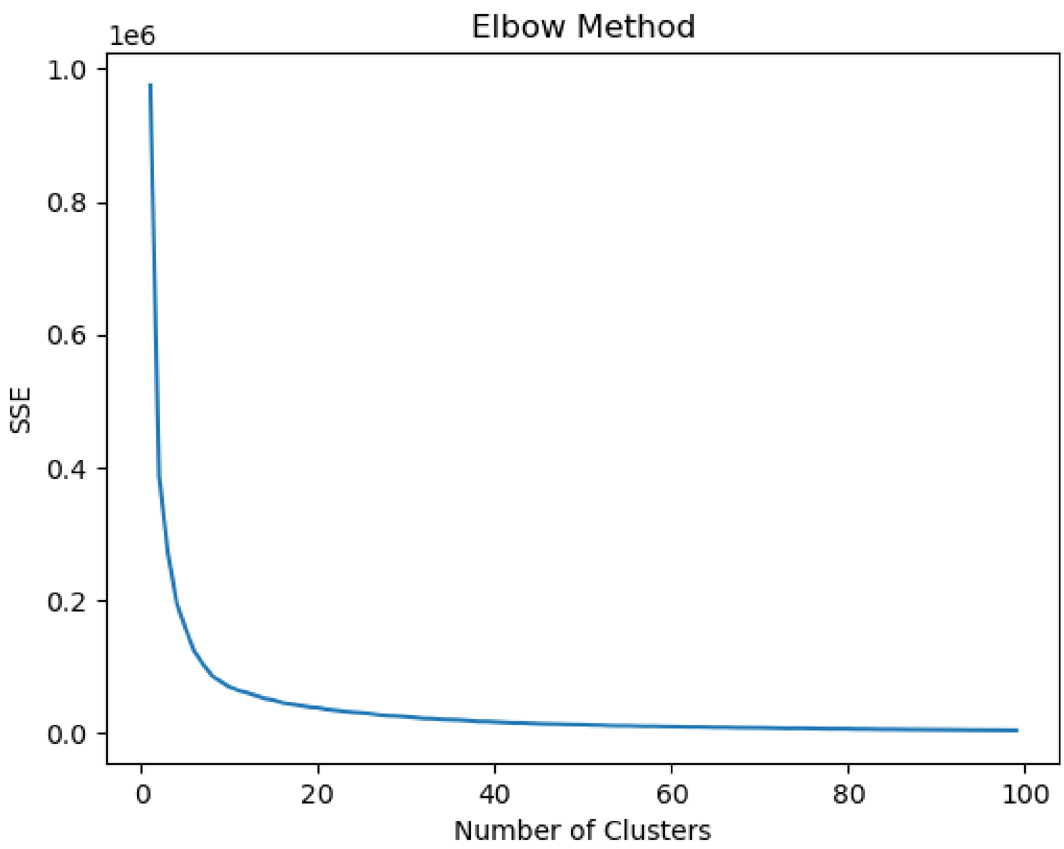
```
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: FutureWarning: The default value of
`n_init` will change from 10 to 'auto' in 1.4. Set the value of `n_init`
explicitly to suppress the warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
```

```
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
```

```
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
/home/shafeenkhan/miniconda3/lib/python3.9/site-
packages/sklearn/cluster/_kmeans.py:1412: 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 warning
  super()._check_params_vs_input(X, default_n_init=10)
```



[ ]:
```
sse
```

```
[ ]: [975512.0600000002,
      387065.71377137717,
      271396.5629660315,
      195401.19855991466,
      157505.72072477575,
      122628.06240556827,
      103233.01724386726,
      86224.13300831638,
      77197.83045987829,
      69256.218214153,
      64078.64810561815,
      60415.07038273617,
      56164.12003785688,
      52000.059677487116,
      49536.3015056787,
      45392.271103380626,
      43482.277607007716,
      41390.41563958917,
      39077.987194749694,
      38021.792982017985,
      35487.404856254856,
      34128.67008547008,
      32506.279195804196,
      31215.44267399267,
      30349.20183982684,
      28965.274270174268,
      27081.766378066382,
      26049.503860028857,
      25545.369957983192,
      24501.152064602065,
      23239.572619047616,
      21876.81920856921,
      21577.355555555554,
      20466.460678210675,
      20133.951010101013,
      19637.107142857145,
      18779.138492063492,
      17511.90634920635,
      17447.82896825397,
      16759.728968253967,
      16073.490476190476,
      15337.758333333333,
      15345.259523809524,
      14634.951984126985,
      14036.597619047618,
      13625.909523809525,
      13445.32380952381,
```

12952.861111111113,
12737.736904761905,
12523.022619047617,
11908.760714285714,
11785.12619047619,
11094.97261904762,
10872.544047619047,
10899.99880952381,
10538.332142857143,
10147.633333333333,
10270.183333333334,
9816.682142857144,
9694.45119047619,
9481.630952380954,
9154.076190476191,
9218.49642857143,
8892.838095238094,
8568.316666666668,
8609.285714285714,
8134.675000000001,
8022.025,
7934.566666666666,
7816.95,
7539.830952380951,
7227.083333333334,
6900.2,
7086.383333333333,
6960.204761904762,
6725.2880952380965,
6429.454761904763,
6179.2333333333345,
6301.004761904762,
6180.016666666666,
5853.633333333333,
5840.671428571429,
5556.0,
5337.866666666667,
5383.733333333334,
5241.450000000001,
4957.966666666667,
5012.566666666667,
4812.766666666666,
4754.6,
4677.766666666666,
4583.766666666666,
4472.083333333334,
4300.933333333333,

```
 4256.833333333334,
 4166.200000000001,
 4114.166666666667,
 3955.25,
 3917.15]
```

[ ]:
```
new_data = df
```

[ ]:
```
# Assuming the optimum number of clusters is 3 and you have new data 'new_data'
kmeans = KMeans(n_clusters=10, max_iter=300, n_init=10, random_state=0)
kmeans.fit(df)
labels = kmeans.predict(new_data)
```

[ ]:
```
labels
```

[ ]:
```
array([6, 1, 6, 1, 6, 1, 6, 1, 6, 1, 6, 1, 6, 1, 6, 1, 6, 1, 6, 1,
       6, 1, 6, 1, 6, 1, 6, 1, 6, 1, 6, 1, 6, 1, 6, 1, 6, 1, 6, 9,
       6, 9, 9, 9, 9, 9, 3, 9, 9, 3, 3, 3, 3, 3, 9, 3, 3, 9, 3, 3, 3, 9,
       3, 3, 9, 9, 3, 3, 3, 3, 3, 7, 3, 3, 7, 3, 3, 7, 3, 3, 7, 3, 3, 7,
       7, 2, 2, 7, 2, 7, 7, 7, 2, 7, 2, 7, 7, 2, 2, 7, 2, 7, 2, 2, 2, 2,
       2, 7, 2, 7, 7, 7, 2, 2, 2, 2, 7, 2, 2, 8, 0, 8, 0, 8, 0, 8, 0, 8,
       0, 8, 0, 8, 0, 8, 0, 8, 0, 8, 0, 8, 0, 8, 0, 8, 0, 8, 0, 8, 0, 8,
       0, 8, 0, 8, 0, 8, 0, 8, 0, 8, 4, 5, 4, 5, 4, 5, 4, 5, 4, 5, 4, 5,
       4, 5, 4, 5, 4, 5, 4, 5, 4, 5, 4, 5, 4, 5, 4, 5, 4, 5, 4, 5, 4, 5,
       4, 5], dtype=int32)
```

[ ]:
```
plt.figure(figsize=(8, 6))

# Scatter plot of data points colored by labels
plt.scatter(df["CustomerID"],labels ,c=labels , marker='x', label='Centroids')
# plt.scatter(centroids[:, 0], centroids[:, 1], c='red', marker='o',␣
 ↪edgecolor='black', s=100)  # Ensure markers are visible

# plt.scatter(centroids[:, 0], centroids[:, 1], c='blue', marker='x',␣
 ↪label='Centroids')
# plt.scatter(centroids[:, 0], centroids[:, 1], c='blue', marker='o',␣
 ↪edgecolor='black', s=100)  # Ensure markers are visible
#
# plt.scatter(centroids[:, 0], centroids[:, 1], c='green', marker='x',␣
 ↪label='Centroids')
# plt.scatter(centroids[:, 0], centroids[:, 1], c='green', marker='o',␣
 ↪edgecolor='black', s=100)  # Ensure markers are visible

plt.xlabel('Feature 1')
plt.ylabel('Feature 2')
plt.title('K-Means Clustering')
```

```
plt.legend()
plt.grid(True)
plt.show()
```