```
#Assignment: V


import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import pylab as pl
%matplotlib inline


cust_df= pd.read_csv("Cust_Segmentation_csv.csv")
cust_df.head()
```

	Customer Id	Age	Edu	Years Employed	Income	Card Debt	Other Debt	Defaulted	Address	DebtIncomeRatio
0	1	41	2	6	19	0.124	1.073	0.0	NBA001	6.3
1	2	47	1	26	100	4.582	8.218	0.0	NBA021	12.8
2	3	33	2	10	57	6.111	5.802	1.0	NBA013	20.9
3	4	29	2	4	19	0.681	0.516	0.0	NBA009	6.3
4	5	47	1	31	253	9.308	8.908	0.0	NBA008	7.2

```
#pre-processing
df= cust_df.drop('Address', axis=1)
df.head()
```

	Customer Id	Age	Edu	Years Employed	Income	Card Debt	Other Debt	Defaulted	DebtIncomeRatio
0	1	41	2	6	19	0.124	1.073	0.0	6.3
1	2	47	1	26	100	4.582	8.218	0.0	12.8
2	3	33	2	10	57	6.111	5.802	1.0	20.9
3	4	29	2	4	19	0.681	0.516	0.0	6.3
4	5	47	1	31	253	9.308	8.908	0.0	7.2

```
#normalizing over standard division
from sklearn.preprocessing import StandardScaler
X= df.values[:,1:]
X=np.nan_to_num(X)
clus_dataset= StandardScaler().fit_transform(X)
clus_dataset
```

```
array([[ 0.74291541,  0.31212243, -0.37878978, ..., -0.59048916,
        -0.52379654, -0.57652509],
       [ 1.48949049, -0.76634938,  2.5737211 , ...,  1.51296181,
        -0.52379654,  0.39138677],
       [-0.25251804,  0.31212243,  0.2117124 , ...,  0.80170393,
         1.90913822,  1.59755385],
       ...,
       [-1.24795149,  2.46906604, -1.26454304, ...,  0.03863257,
         1.90913822,  3.45892281],
       [-0.37694723, -0.76634938,  0.50696349, ..., -0.70147601,
        -0.52379654, -1.08281745],
       [ 2.1116364 , -0.76634938,  1.09746566, ...,  0.16463355,
        -0.52379654, -0.2340332 ]])
```

```
#modelling
from sklearn.cluster import KMeans
clusterNum = 3
k_means = KMeans (init ="k-means++", n_clusters=clusterNum, n_init=12)
k_means.fit(X)
labels = k_means.labels_
print(labels)
```

```
[0 1 0 0 2 1 0 1 0 1 1 0 0 0 0 0 0 1 0 0 0 0 1 1 1 0 0 1 0 1 0 0 0 0 0 0
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 0 0 0 0 0 0 1 0 0 0 2 0 0 0 0 1 0 2 0 0 0 0 1 0 1 1 1 0 0 1 1 0 0 0 0 0 0
 0 1 0 0 0 0 1 0 0 0 1 0 1 0 0 0 1 0 0 0 0 1 1 0 0 0 0 1 0 0 0 0 1 0 0 0 0
```

```
0 1 1 0 0 0 0 0 0 0 0 0 0 2 1 0 0 0 0 0 1 0 0 0 1 0 0 1 0 0 2 0 2 0
0 2 0 0 0 0 0 0 0 0 1 0 1 0 0 2 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 1 0 1
0 0 0 0 0 0 1 0 0 0 0 1 0 1 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 1
1 0 0 1 0 1 0 0 1 0 1 0 0 2 0 1 0 1 0 0 0 0 0 1 1 0 0 0 0 1 0 0 0 1 1 0 0
1 0 0 0 1 0 2 0 0 1 0 0 0 0 0 0 0 1 0 0 0 1 0 0 0 0 0 1 0 0 1 0 0 0 0 0 0
0 0 1 0 0 1 0 1 0 1 1 0 0 0 0 1 0 1 0 0 0 0 0 1 0 0 0 0 0 1 1 0 0 1 1 0 0 0 0
0 1 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 1 0 1 1 0 1 0 1 1 0 0 1 0 0 0 0 0 1 1
0 0 0 0 0 0 0 1 0 0 0 0 0 0 2 1 1 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 1 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 1]
```

```
df["Clus_km"]=labels
df.head(5)
```

	Customer Id	Age	Edu	Years Employed	Income	Card Debt	Other Debt	Defaulted	DebtIncomeRatio	Clus_km
0	1	41	2	6	19	0.124	1.073	0.0	6.3	0
1	2	47	1	26	100	4.582	8.218	0.0	12.8	1
2	3	33	2	10	57	6.111	5.802	1.0	20.9	0
3	4	29	2	4	19	0.681	0.516	0.0	6.3	0
4	5	47	1	31	253	9.308	8.908	0.0	7.2	2

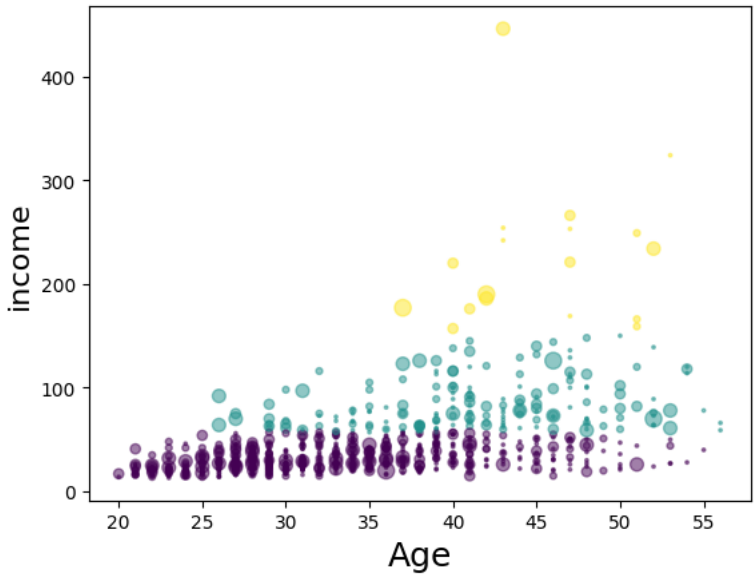
```
df.groupby('Clus_km').mean()
```

Clus_km	Customer Id	Age	Edu	Years Employed	Income	Card Debt	Other Debt	Defaulted	DebtIncomeRatio
0	432.468413	32.964561	1.614792	6.374422	31.164869	1.032541	2.104133	0.285185	10.094761
1	402.295082	41.333333	1.956284	15.256831	83.928962	3.103639	5.765279	0.171233	10.724590
2	410.166667	45.388889	2.666667	19.555556	227.166667	5.678444	10.907167	0.285714	7.322222

```
area = np.pi*(X[:,1])**2
plt.scatter(X[:,0],X[:,3], s=area, c=labels.astype(np.float),alpha=0.5)
plt.xlabel('Age', fontsize=18)
plt.ylabel('income', fontsize=16)

plt.show()
```

```
<ipython-input-21-2fa503bc9657>:2: DeprecationWarning: `np.float` is a deprecated alias for the builtin `float`. To silence this war
Deprecated in NumPy 1.20; for more details and guidance: https://numpy.org/devdocs/release/1.20.0-notes.html#deprecations
  plt.scatter(X[:,0],X[:,3], s=area, c=labels.astype(np.float),alpha=0.5)
```



```
from mpl_toolkits.mplot3d import Axes3D
fig = plt.figure(1, figsize=(8, 6))
plt.clf()
ax = Axes3D(fig, rect=[0, 0, .95, 1], elev=48, azim=134)
plt.cla()
# plt.ylabel('Age', fontsize=18)
# plt.xlabel('Income', fontsize=16)
# plt.zlabel('Education', fontsize=16)
ax.set_xlabel('Education')
ax.set_ylabel('Age')
ax.set_zlabel('Income')

ax.scatter(X[:, 1], X[:, 0], X[:, 3], c= labels.astype(np.float))
```

```
<ipython-input-26-6d2ba62b5239>:13: DeprecationWarning: `np.float` is a deprecated alias for the builtin `float`. To silence this wa
Deprecated in NumPy 1.20; for more details and guidance: https://numpy.org/devdocs/release/1.20.0-notes.html#deprecations
  ax.scatter(X[:, 1], X[:, 0], X[:, 3], c= labels.astype(np.float))
<mpl_toolkits.mplot3d.art3d.Path3DCollection at 0x7ac4e507a320>
```