In [6]:
```python
import pandas as p
import numpy as n
import seaborn as s
import matplotlib.pyplot as plt
df = p.read_csv("Mall_Customers.csv")
df
```

Out[6]:

	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 [7]:
```python
x = df.iloc[:,3:]
x
```

Out[7]:

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

200 rows × 2 columns

In [8]:
```python
from sklearn.cluster import KMeans
```

In [9]:
```python
sse = []
for i in range(1,16):
    km = KMeans(n_clusters=i)
    km.fit_predict(x)
    sse.append(km.inertia_)
sse
```

```
C:\Users\suraj fartale\AppData\Roaming\Python\Python311\site-packages\sk
learn\cluster\_kmeans.py:1416: FutureWarning: The default value of `n_in
it` will change from 10 to 'auto' in 1.4. Set the value of `n_init` expl
icitly to suppress the warning
  super()._check_params_vs_input(X, default_n_init=10)
C:\Users\suraj fartale\AppData\Roaming\Python\Python311\site-packages\sk
learn\cluster\_kmeans.py:1440: UserWarning: KMeans is known to have a me
mory leak on Windows with MKL, when there are less chunks than available
threads. You can avoid it by setting the environment variable OMP_NUM_TH
READS=1.
  warnings.warn(
C:\Users\suraj fartale\AppData\Roaming\Python\Python311\site-packages\sk
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C:\Users\suraj fartale\AppData\Roaming\Python\Python311\site-packages\sk
learn\cluster\_kmeans.py:1440: UserWarning: KMeans is known to have a me
mory leak on Windows with MKL, when there are less chunks than available
```

In [12]:
```python
plt.figure(figsize=(16,9))
plt.plot(range(1,16),sse,marker='.',color='red')
```

Out[12]: [<matplotlib.lines.Line2D at 0x211904e2ad0>]

In [13]:
```python
from sklearn.metrics import silhouette_score
```

In [16]:
```python
silh= []
for i in range(2,16):
    km = KMeans(n_clusters = i)
    labels = km.fit_predict(x)
    score = silhouette_score(x,labels)
    silh.append(score)
```
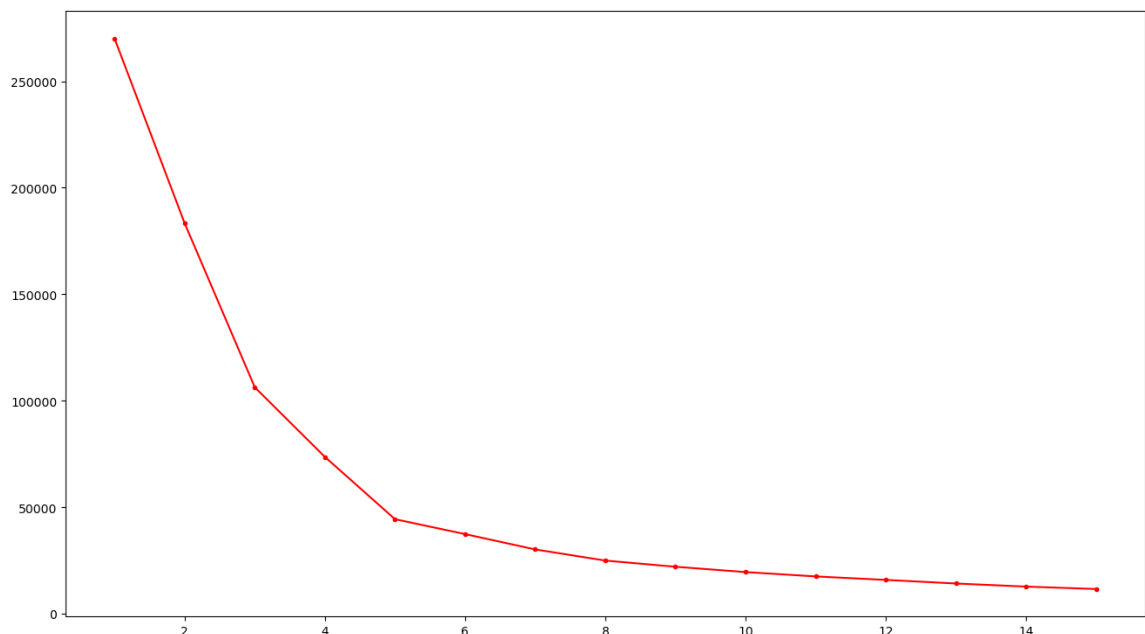
```
C:\Users\suraj fartale\AppData\Roaming\Python\Python311\site-packages\skle
arn\cluster\_kmeans.py:1416: FutureWarning: The default value of `n_init`
will change from 10 to 'auto' in 1.4. Set the value of `n_init` explicitly
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```
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leak on Windows with MKL, when there are less chunks than available thread
s. You can avoid it by setting the environment variable OMP_NUM_THREADS=1.
  warnings.warn(
```

In [17]:
```python
plt.figure(figsize=(16,9))
plt.bar(range(2,16),silh,color='red')
```

Out[17]: <BarContainer object of 14 artists>

In [32]:
```python
km = KMeans(n_clusters = 5,random_state=0)
labels = km.fit_predict(x)
labels
```

C:\Users\suraj fartale\AppData\Roaming\Python\Python311\site-packages\skle
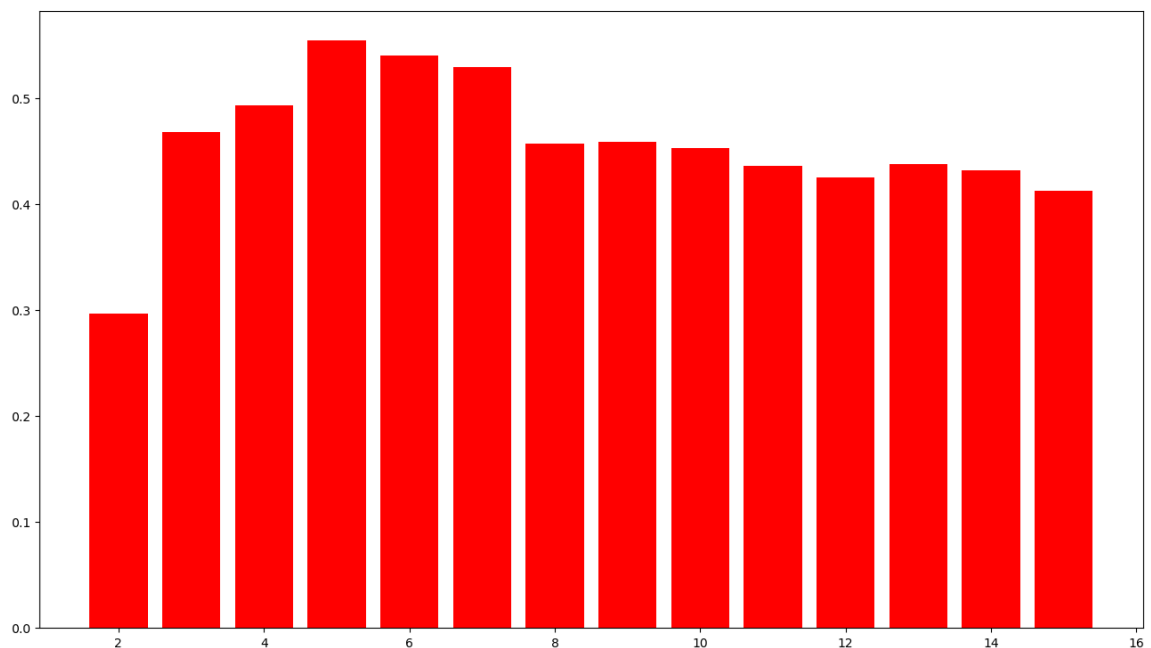arn\cluster_kmeans.py:1416: FutureWarning: The default value of `n_init`
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C:\Users\suraj fartale\AppData\Roaming\Python\Python311\site-packages\skle
arn\cluster_kmeans.py:1440: UserWarning: KMeans is known to have a memory
leak on Windows with MKL, when there are less chunks than available thread
s. You can avoid it by setting the environment variable OMP_NUM_THREADS=1.
  warnings.warn(

Out[32]:
```
array([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, 3, 0,
       3, 4, 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, 1, 2, 1, 0, 1, 2, 1, 2, 1,
       0, 1, 2, 1, 2, 1, 2, 1, 2, 1, 0, 1, 2, 1, 2, 1, 2, 1, 2, 1, 2, 1,
       2, 1, 2, 1, 2, 1, 2, 1, 2, 1, 2, 1, 2, 1, 2, 1, 2, 1, 2, 1, 2, 1,
       2, 1, 2, 1, 2, 1, 2, 1, 2, 1, 2, 1, 2, 1, 2, 1, 2, 1, 2, 1, 2, 1,
       2, 1])
```

In [33]:
```python
cent = km.cluster_centers_
cent
```

Out[33]:
```
array([[55.2962963 , 49.51851852],
       [86.53846154, 82.12820513],
       [88.2       , 17.11428571],
       [26.30434783, 20.91304348],
       [25.72727273, 79.36363636]])
```

In [38]:
```python
# plt.title("Clustering")
# plt.xlabel("Annual Income")
# plt.ylabel("Spending Score")
# plt.scatter(x["Annual Income (k$)"],x["Spending Score (1-100)"],c=labels)
# plt.scatter(cent[:,0],cent[:,1],s=50,color='k')
plt.figure(figsize=(16,9))
plt.scatter(x["Annual Income (k$)"],x["Spending Score (1-100)"],c=labels)
plt.scatter(cent[:,0],cent[:,1],s=50,color='red')
```

Out[38]: `<matplotlib.collections.PathCollection at 0x2119b56e4d0>`
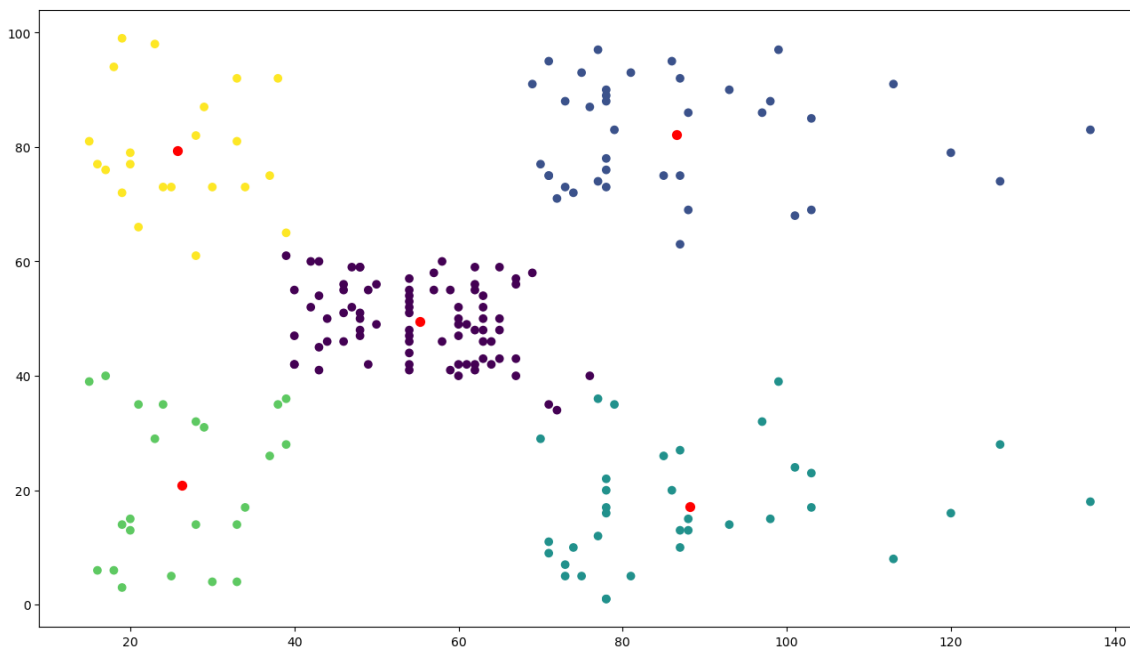
In [44]:
```python
df[labels==0]
```

Out[44]:

	CustomerID	Genre	Age	Annual Income (k$)	Spending Score (1-100)
43	44	Female	31	39	61
46	47	Female	50	40	55
47	48	Female	27	40	47
48	49	Female	29	40	42
49	50	Female	31	40	42
...	...	...	...	...	...
121	122	Female	38	67	40
122	123	Female	40	69	58
126	127	Male	43	71	35
132	133	Female	25	72	34
142	143	Female	28	76	40

81 rows × 5 columns

In [46]:
```python
from sklearn.cluster import AgglomerativeClustering
```

In [47]:
```python
agl = AgglomerativeClustering(n_clusters= 5)
alabels = agl.fit_predict(x)
alabels
```

Out[47]:
```
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, 3, 4, 1,
       4, 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, 1, 1, 1, 1, 1, 2, 1, 2, 1, 2, 0, 2, 0, 2,
       1, 2, 0, 2, 0, 2, 0, 2, 0, 2, 1, 2, 0, 2, 1, 2, 0, 2, 0, 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], dtype=int64)
```

In [54]:
```python
plt.figure(figsize=(16,9))
plt.scatter(x["Annual Income (k$)"],x["Spending Score (1-100)"],c=alabels,li
```

Out[54]:
```
<matplotlib.collections.PathCollection at 0x2119baf6a90>
```


In [ ]: