In [2]:
```python
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
import numpy as np
from imblearn.over_sampling import SMOTE
from sklearn.model_selection import train_test_split, cross_val_score
from sklearn.preprocessing import StandardScaler
from sklearn.linear_model import LogisticRegression
from sklearn.neighbors import KNeighborsClassifier
from sklearn.tree import DecisionTreeClassifier
from sklearn.ensemble import RandomForestClassifier
from sklearn.svm import SVC
from sklearn.naive_bayes import GaussianNB
from sklearn.discriminant_analysis import LinearDiscriminantAnalysis
from sklearn.discriminant_analysis import QuadraticDiscriminantAnalysis
from sklearn.ensemble import AdaBoostClassifier
from sklearn.ensemble import GradientBoostingClassifier
from xgboost import XGBClassifier
from lightgbm import LGBMClassifier
from catboost import CatBoostClassifier
from sklearn.neural_network import MLPClassifier
from sklearn.gaussian_process import GaussianProcessClassifier
from sklearn.ensemble import BaggingClassifier
from sklearn.ensemble import ExtraTreesClassifier
from sklearn.metrics import accuracy_score, precision_score, recall_score, f1_score, confusion_matrix
from sklearn.impute import SimpleImputer
```

In [3]:
```python
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.cluster import KMeans
```

In [4]:
```python
data = pd.read_csv("Mall_Customers.csv")
```

In [5]:
```python
data.head(5)
```

Out[5]:

	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 [6]:
```python
data.tail(5)
```

Out[6]:

	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 [7]:
```python
data.shape
```

Out[7]:
```
(200, 5)
```

In [8]:
```python
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   Genre                   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
```

In [9]:
```python
data.describe()
```

Out[9]:

	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

In [10]:
```python
data.dtypes
```

Out[10]:
```
CustomerID                 int64
Genre                     object
Age                        int64
Annual Income (k$)         int64
Spending Score (1-100)     int64
dtype: object
```

In [11]:
```python
data.isnull().sum()
```

Out[11]:
```
CustomerID                0
Genre                     0
Age                       0
Annual Income (k$)        0
Spending Score (1-100)    0
dtype: int64
```

In [12]:
```python
x = data.iloc[:, [3,4]].values
```

In [13]:
```python
from sklearn.cluster import KMeans
```

In [14]:
```python
wcss = []

for i in range (1,11):
    kmeans = KMeans(n_clusters =i , init ="k-means++", random_state=0)
    kmeans.fit(x)
    wcss.append(kmeans.inertia_)
```

```
C:\Users\Sutharsahana\.ms-ad\lib\site-packages\sklearn\cluster\_kmeans.py:870: FutureWarning: The default value of `n_init` will change from 10 to 'auto' in 1.4. Set the valu
e of `n_init` explicitly to suppress the warning
  warnings.warn(
C:\Users\Sutharsahana\.ms-ad\lib\site-packages\sklearn\cluster\_kmeans.py:1382: UserWarning: KMeans is known to have a memory leak on Windows with MKL, when there are less ch
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C:\Users\Sutharsahana\.ms-ad\lib\site-packages\sklearn\cluster\_kmeans.py:870: FutureWarning: The default value of `n_init` will change from 10 to 'auto' in 1.4. Set the valu
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C:\Users\Sutharsahana\.ms-ad\lib\site-packages\sklearn\cluster\_kmeans.py:1382: UserWarning: KMeans is known to have a memory leak on Windows with MKL, when there are less ch
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C:\Users\Sutharsahana\.ms-ad\lib\site-packages\sklearn\cluster\_kmeans.py:1382: UserWarning: KMeans is known to have a memory leak on Windows with MKL, when there are less ch
unks than available threads. You can avoid it by setting the environment variable OMP_NUM_THREADS=1.
  warnings.warn(
```
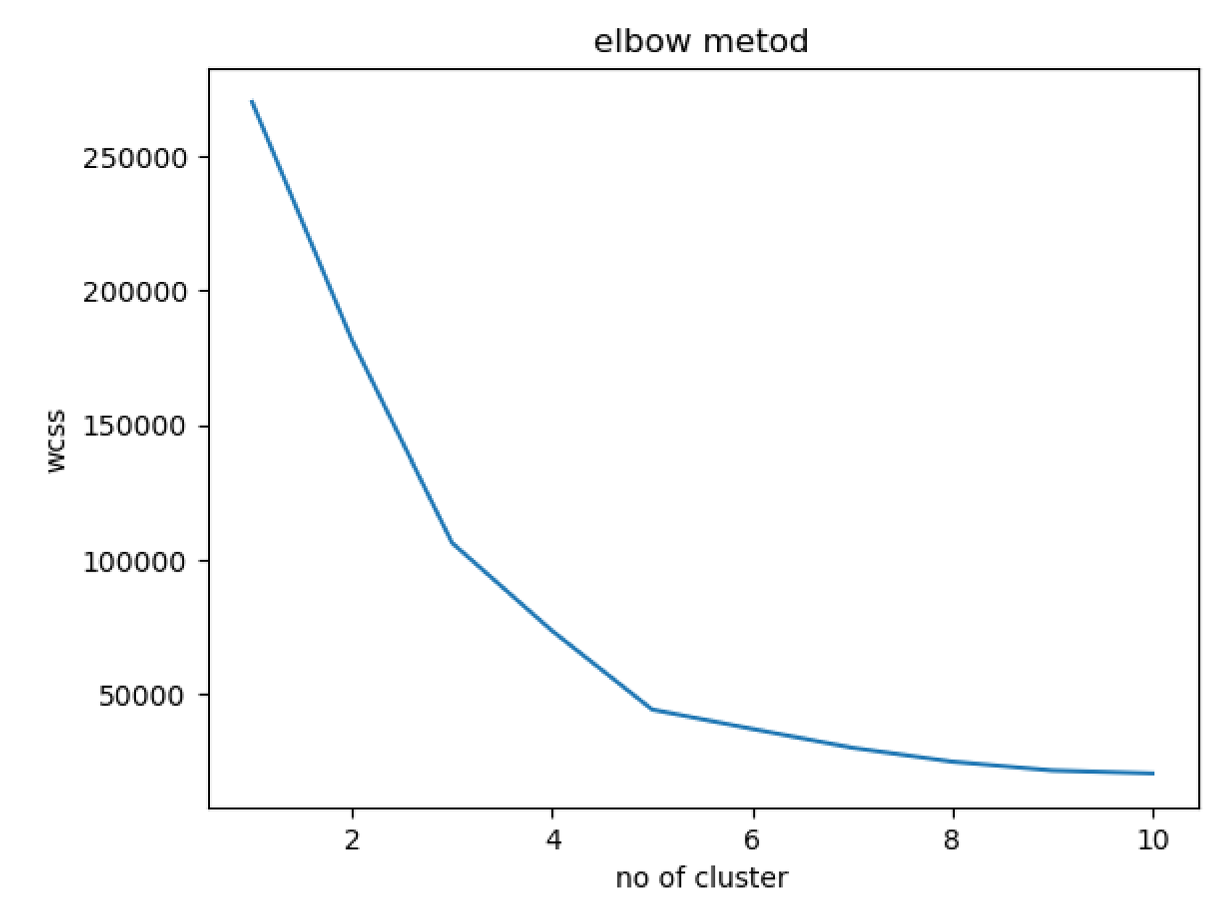

In [15]:
```python
plt.plot(range(1,11), wcss)
plt.title("elbow metod")
plt.xlabel("no of cluster")
plt.ylabel("wcss")
plt.show()
```



In [16]:
```python
correlation = data.corr ()
correlation.style.background_gradient (cmap = 'BrBG')
```

```
C:\Users\Sutharsahana\AppData\Local\Temp\ipykernel_35584\1153448485.py:1: FutureWarning: The default value of numeric_only in DataFrame.corr is deprecated. In a future versio
n, it will default to False. Select only valid columns or specify the value of numeric_only to silence this warning.
  correlation = data.corr ()
```

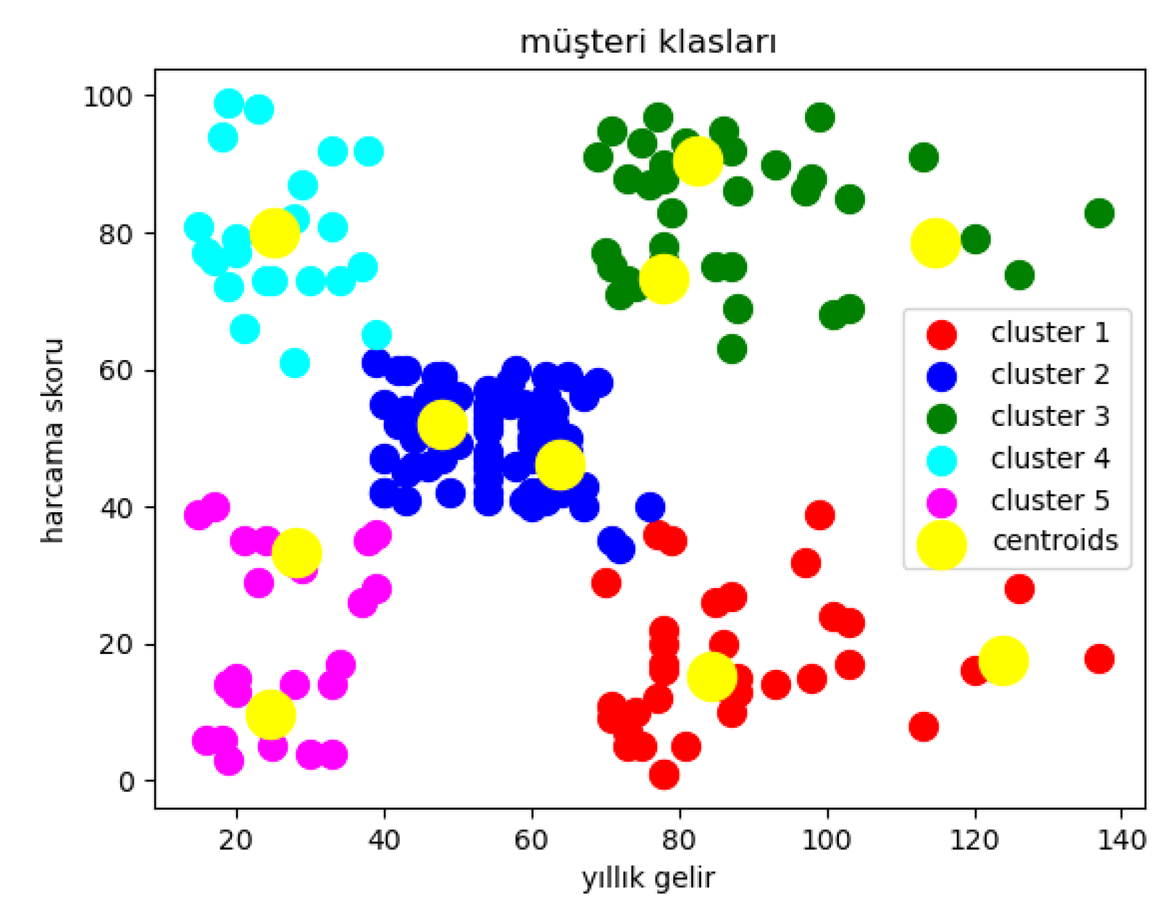
Out[16]:

	CustomerID	Age	Annual Income (k$)	Spending Score (1-100)
CustomerID	1.000000	-0.026763	0.977548	0.013835
Age	-0.026763	1.000000	-0.012398	-0.327227
Annual Income (k$)	0.977548	-0.012398	1.000000	0.009903
Spending Score (1-100)	0.013835	-0.327227	0.009903	1.000000

In [17]:
```python
kmeansmodel = KMeans(n_clusters=5, init="k-means++", random_state=0)
y_kmeans = kmeansmodel.fit_predict(x)
```

```
C:\Users\Sutharsahana\.ms-ad\lib\site-packages\sklearn\cluster\_kmeans.py:870: FutureWarning: The default value of `n_init` will change from 10 to 'auto' in 1.4. Set the valu
e of `n_init` explicitly to suppress the warning
  warnings.warn(
C:\Users\Sutharsahana\.ms-ad\lib\site-packages\sklearn\cluster\_kmeans.py:1382: UserWarning: KMeans is known to have a memory leak on Windows with MKL, when there are less ch
unks than available threads. You can avoid it by setting the environment variable OMP_NUM_THREADS=1.
  warnings.warn(
```

In [18]:
```python
plt.scatter(x[y_kmeans == 0, 0], x[y_kmeans == 0, 1], s= 100, c ="red", label= "cluster 1")
plt.scatter(x[y_kmeans == 1, 0], x[y_kmeans == 1, 1], s= 100, c ="blue", label= "cluster 2")
plt.scatter(x[y_kmeans == 2, 0], x[y_kmeans == 2, 1], s= 100, c ="green", label= "cluster 3")
plt.scatter(x[y_kmeans == 3, 0], x[y_kmeans == 3, 1], s= 100, c ="cyan", label= "cluster 4")
plt.scatter(x[y_kmeans == 4, 0], x[y_kmeans == 4, 1], s= 100, c ="magenta", label= "cluster 5")

plt.scatter(kmeans.cluster_centers_[:, 0], kmeans.cluster_centers_[:, 1], s=300, c="yellow", label="centroids")
plt.title("müşteri klasları")
plt.xlabel("yıllık gelir")
plt.ylabel("harcama skoru")
plt.legend()
plt.show()
```



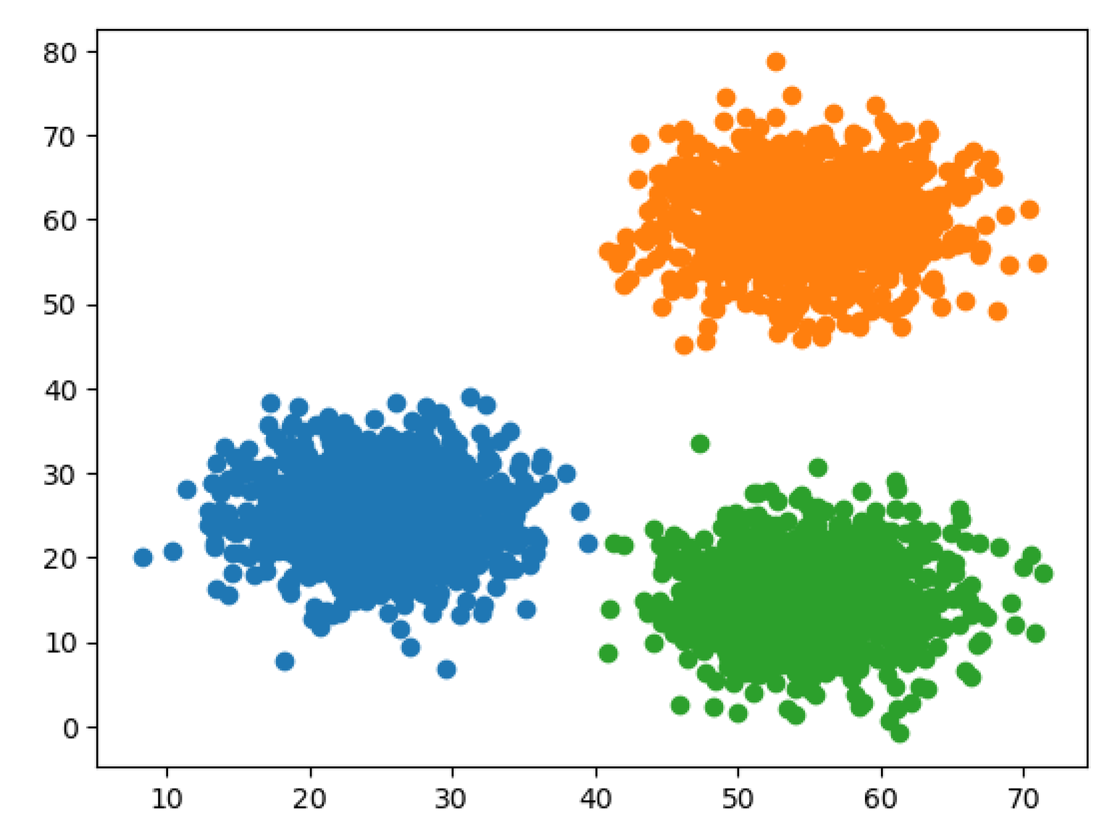
In [19]:
```python
x1 = np.random.normal(25,5,1000)
y1 = np.random.normal(25,5,1000)

x2 = np.random.normal(55,5,1000)
y2 = np.random.normal(60,5,1000)

x3 = np.random.normal(55,5,1000)
y3 = np.random.normal(15,5,1000)
```

In [20]:
```python
x = np.concatenate((x1,x2,x3),axis = 0)
y = np.concatenate((y1,y2,y3),axis = 0)
```

In [21]:
```python
dictionary = {"x":x,"y":y}
```

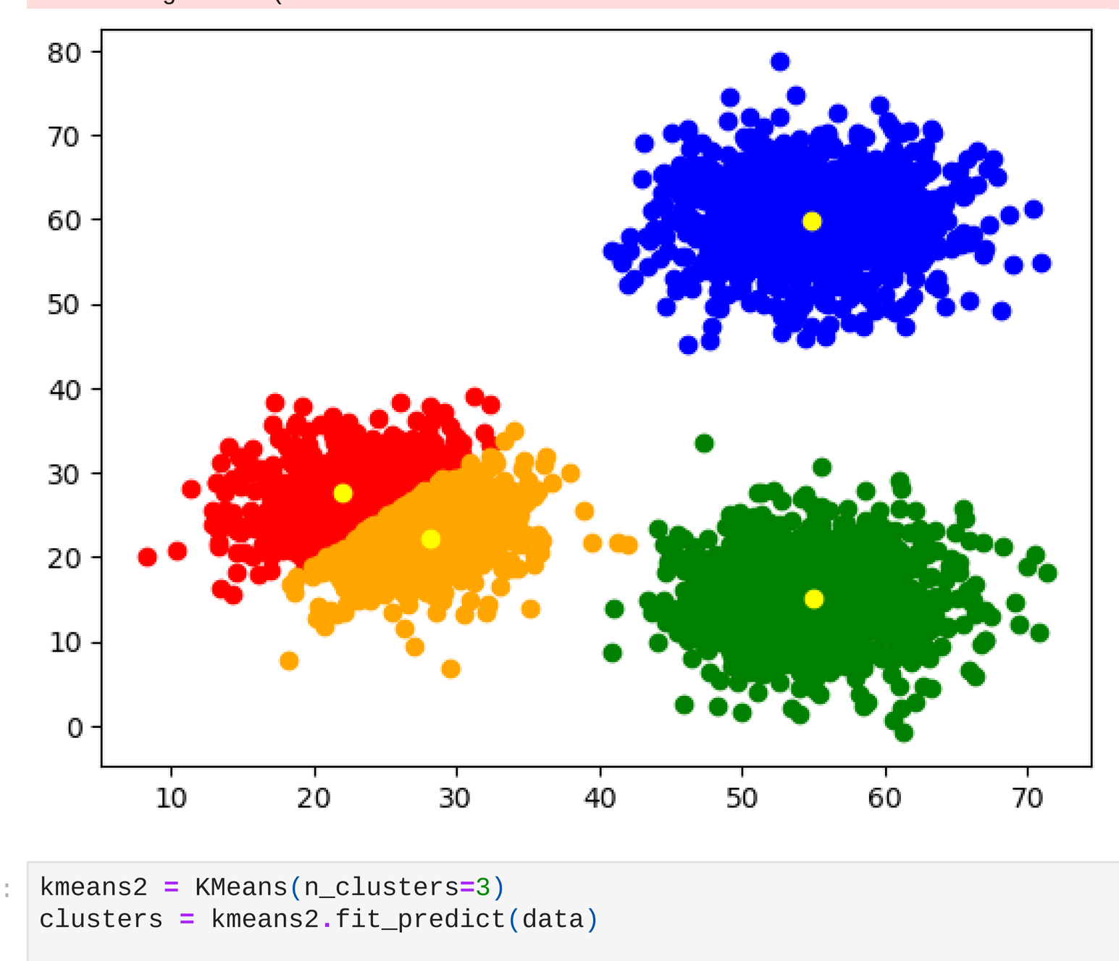
In [22]:
```python
data = pd.DataFrame(dictionary)
```

In [23]:
```python
plt.scatter(x1,y1)
plt.scatter(x2,y2)
plt.scatter(x3,y3)
plt.show()
```



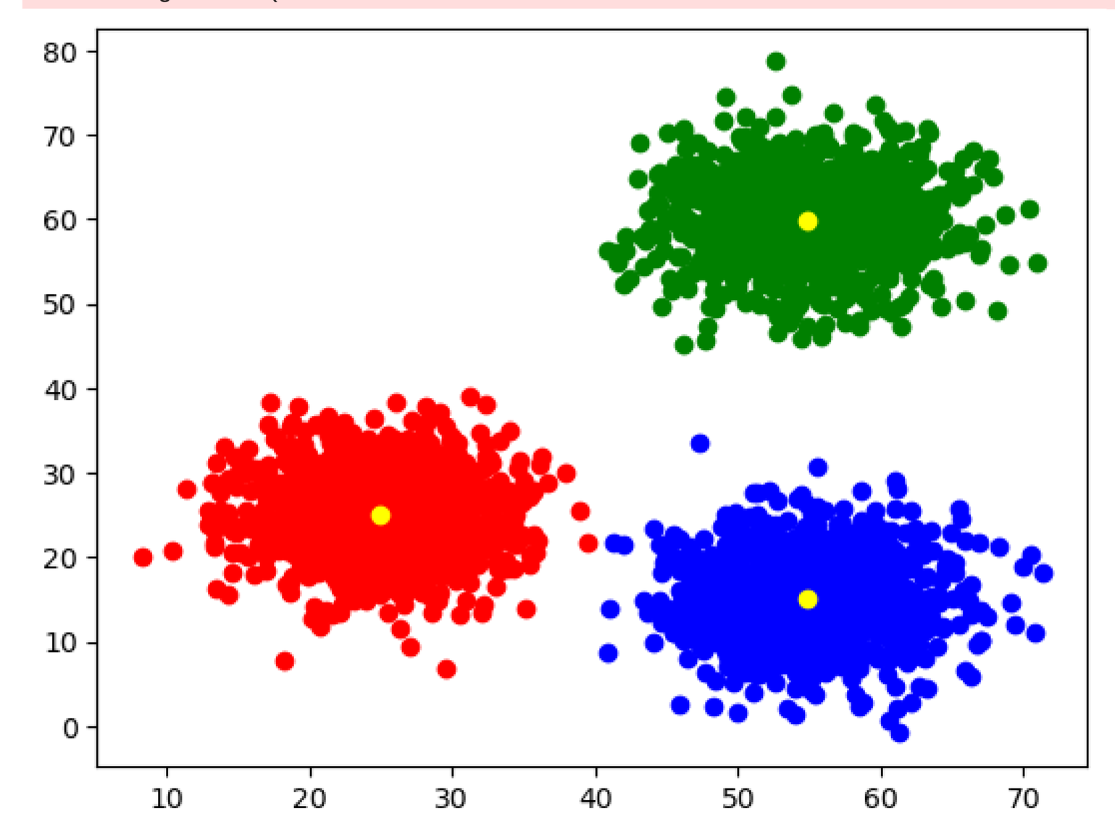
In [24]:
```python
kmeans2 = KMeans(n_clusters=4)
clusters = kmeans2.fit_predict(data)

data["label"] = clusters

plt.scatter(data.x[data.label == 0 ],data.y[data.label == 0],color = "red")
plt.scatter(data.x[data.label == 1 ],data.y[data.label == 1],color = "green")
plt.scatter(data.x[data.label == 2 ],data.y[data.label == 2],color = "blue")
plt.scatter(data.x[data.label == 3 ],data.y[data.label == 3],color = "orange")
plt.scatter(kmeans2.cluster_centers_[:,0],kmeans2.cluster_centers_[:,1],color = "yellow")
plt.show()
```

```
C:\Users\Sutharsahana\.ms-ad\lib\site-packages\sklearn\cluster\_kmeans.py:870: FutureWarning: The default value of `n_init` will change from 10 to 'auto' in 1.4. Set the valu
e of `n_init` explicitly to suppress the warning
  warnings.warn(
```



In [25]:
```python
kmeans2 = KMeans(n_clusters=3)
clusters = kmeans2.fit_predict(data)

data["label"] = clusters

plt.scatter(data.x[data.label == 0 ],data.y[data.label == 0],color = "red")
plt.scatter(data.x[data.label == 1 ],data.y[data.label == 1],color = "green")
plt.scatter(data.x[data.label == 2 ],data.y[data.label == 2],color = "blue")
plt.scatter(kmeans2.cluster_centers_[:,0],kmeans2.cluster_centers_[:,1],color = "yellow")
plt.show()
```

```
C:\Users\Sutharsahana\.ms-ad\lib\site-packages\sklearn\cluster\_kmeans.py:870: FutureWarning: The default value of `n_init` will change from 10 to 'auto' in 1.4. Set the valu
e of `n_init` explicitly to suppress the warning
  warnings.warn(
```



In [ ]:

In [ ]:

In [ ]:

In [ ]: