In [51]:

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import random as rd
```

In [52]:

```
data=pd.read_csv('thyroid.csv')                                                     #reading t
data.columns=['T3','TST','TSTI','TSH','Maximal Absolute Difference','Label']     #addigng c
data.head()
```

Out[52]:

	T3	TST	TSTI	TSH	Maximal Absolute Difference	Label
0	113	9.9	3.1	2.0	5.9	1
1	127	12.9	2.4	1.4	0.6	1
2	109	5.3	1.6	1.4	1.5	1
3	105	7.3	1.5	1.5	-0.1	1
4	105	6.1	2.1	1.4	7.0	1

In [53]:

```
data.describe()                                      #previewing the statistical info the given dataset
```

Out[53]:

	T3	TST	TSTI	TSH	Maximal Absolute Difference	Label
count	214.000000	214.000000	214.000000	214.000000	214.000000	214.000000
mean	109.607477	9.803271	2.049533	2.889252	4.206075	1.443925
std	13.175063	4.708332	1.422777	6.130868	8.088786	0.727808
min	65.000000	0.500000	0.200000	0.100000	-0.700000	1.000000
25%	103.000000	7.100000	1.325000	1.000000	0.525000	1.000000
50%	110.000000	9.200000	1.700000	1.300000	2.000000	1.000000
75%	117.750000	11.300000	2.200000	1.700000	4.100000	2.000000
max	144.000000	25.300000	10.000000	56.400000	56.300000	3.000000

In [54]:

```
p=data['Label']                     #preparing the label
p=pd.DataFrame(p)                   #converting into dataframe
p.head()
```

Out[54]:

	Label
0	1
1	1
2	1
3	1
4	1

In [55]:

```
k=p['Label']                                         #preparing the label
k=pd.DataFrame(k)                                    #coverting into dataframe
k["Label"].replace({1: 0, 2: 1,3:2}, inplace=True)  #replacing the column values
z=k['Label']                                         #copying the variable
z
```

Out[55]:

```
0      0
1      0
2      0
3      0
4      0
      ..
209    2
210    2
211    2
212    2
213    2
Name: Label, Length: 214, dtype: int64
```

In [56]:

```
X=data.iloc[:, [0,1,2,3,4]].values
X
```

Out[56]:

```
array([[113. ,   9.9,   3.1,   2. ,   5.9],
       [127. ,  12.9,   2.4,   1.4,   0.6],
       [109. ,   5.3,   1.6,   1.4,   1.5],
       ...,
       [103. ,   5.1,   1.4,   1.2,   5. ],
       [ 97. ,   4.7,   1.1,   2.1,  12.6],
       [102. ,   5.3,   1.4,   1.3,   6.7]])
```

In [57]:

```
m=X.shape[0]
m
n=X.shape[1]
n
n_iter=100
```

In [58]:

```
K=3
```

In [59]:

```
Centroids=np.array([]).reshape(n,0)
```

In [60]:

```
for i in range(K):
    rand=rd.randint(0,m-1)
    Centroids=np.c_[Centroids,X[rand]]
```

In [61]:

```
Output={}
```

In [62]:

```
EuclidianDistance=np.array([]).reshape(m,0)
for k in range(K):
       tempDist=np.sum((X-Centroids[:,k])**2,axis=1)
       EuclidianDistance=np.c_[EuclidianDistance,tempDist]
C=np.argmin(EuclidianDistance,axis=1)+1
```

In [63]:

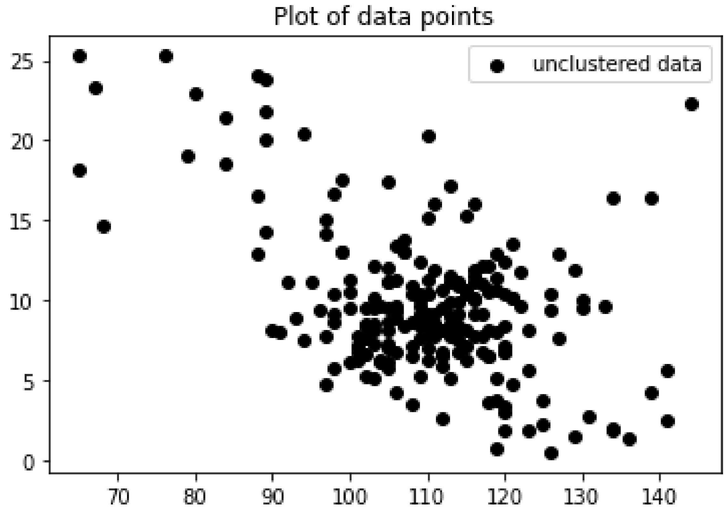
```
Y={}
for k in range(K):
    Y[k+1]=np.array([]).reshape(5,0)
for i in range(m):
    Y[C[i]]=np.c_[Y[C[i]],X[i]]

for k in range(K):
    Y[k+1]=Y[k+1].T

for k in range(K):
     Centroids[:,k]=np.mean(Y[k+1],axis=0)
```

In [64]:

```
for i in range(n_iter):
     #step 2.a
      EuclidianDistance=np.array([]).reshape(m,0)
      for k in range(K):
          tempDist=np.sum((X-Centroids[:,k])**2,axis=1)
          EuclidianDistance=np.c_[EuclidianDistance,tempDist]
      C=np.argmin(EuclidianDistance,axis=1)+1
     #step 2.b
      Y={}
      for k in range(K):
          Y[k+1]=np.array([]).reshape(5,0)
      for i in range(m):
          Y[C[i]]=np.c_[Y[C[i]],X[i]]

      for k in range(K):
          Y[k+1]=Y[k+1].T

      for k in range(K):
          Centroids[:,k]=np.mean(Y[k+1],axis=0)
      Output=Y
```

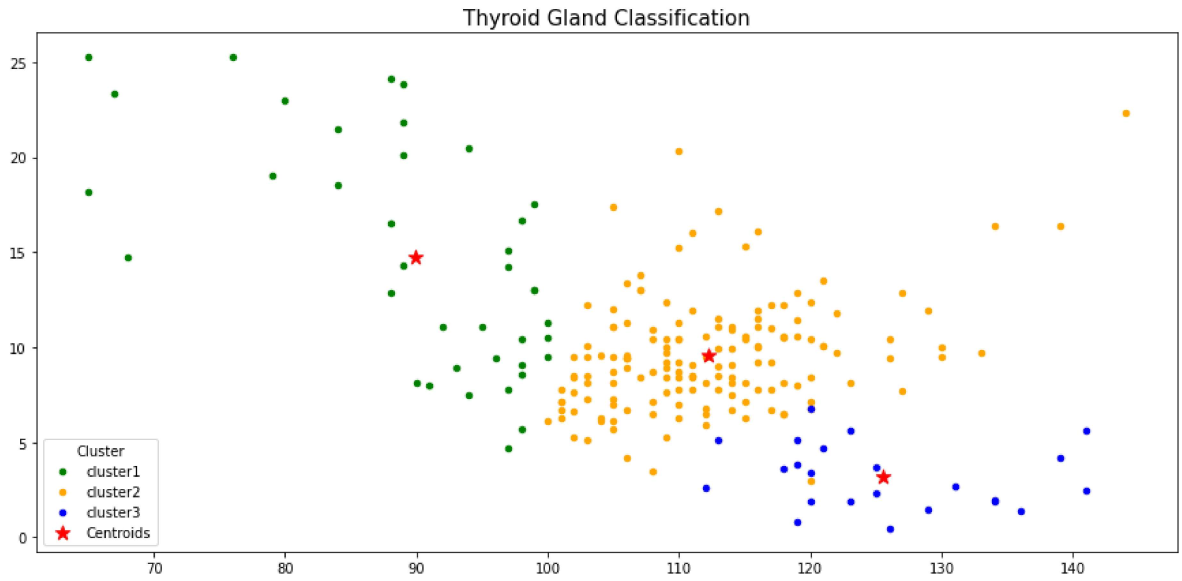
In [65]:

```
plt.scatter(X[:,0],X[:,1],c='black',label='unclustered data')
plt.legend()
plt.title('Plot of data points')
plt.show()
```



In [66]:

```
plt.figure(figsize=(15,7))
color=['green','orange','blue']
labels=['cluster1','cluster2','cluster3']
for k in range(K):
    plt.scatter(Output[k+1][:,0],Output[k+1][:,1],c=color[k],label=labels[k],s=20)
plt.scatter(Centroids[0,:],Centroids[1,:],s=120,c='red',label='Centroids',marker='*')
plt.legend()
plt.title('Thyroid Gland Classification',fontsize=15)
plt.legend(title = 'Cluster')
plt.show()
```



In [67]:

```
from sklearn.cluster import KMeans
```

In [68]:

```
kmeans = KMeans(n_clusters = 3, random_state=101)    # number of clusters set to 5
```

In [69]:

```
y=kmeans.fit_predict(X)
```

In [70]:

```
clusters=kmeans.labels_    #adding the labels to the variable
clusters                   #previewing
```

Out[70]:

```
array([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, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0,
       0, 0, 0, 1, 0, 1, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       1, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 1, 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,
       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, 0, 0, 1, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 1, 1,
       1, 0, 0, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
       0, 0, 0, 1, 1, 0, 1, 1, 2, 2, 0, 0, 2, 2, 2, 2, 2, 2, 2, 0, 2, 2,
       2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 0, 2, 0, 1, 0])
```

In [71]:

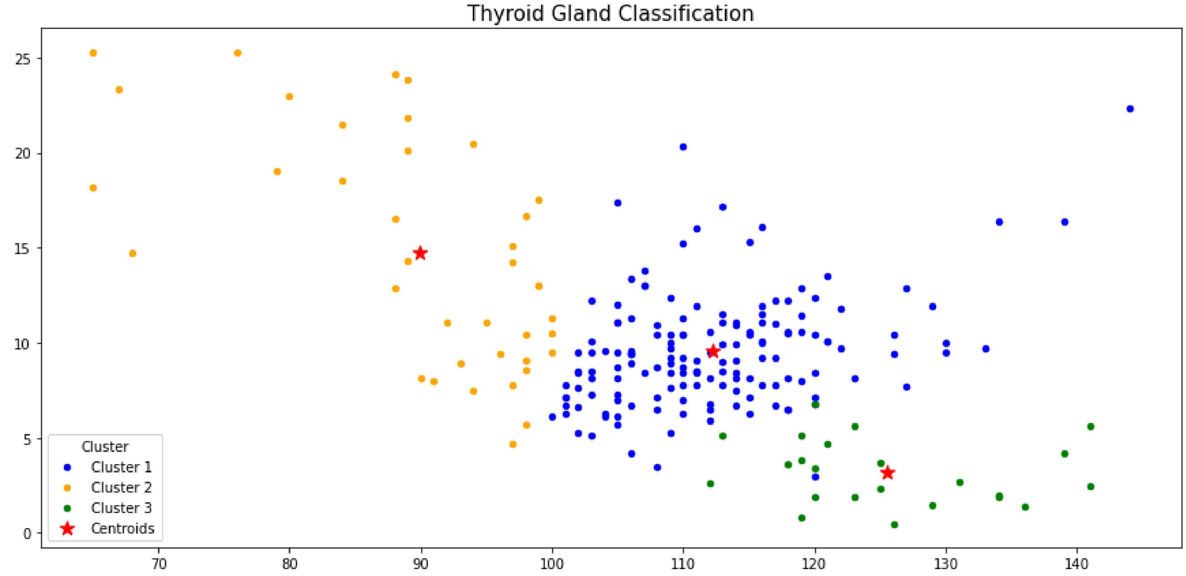
```
centers = kmeans.cluster_centers_      #finding the centriods of the clusters.
centers                                #previewing the centriods
```

Out[71]:

```
array([[112.23684211,   9.54144737,   1.80263158,   1.31118421,
          2.58618421],
       [ 89.94871795,  14.71794872,   3.64615385,   1.16153846,
          0.95128205],
       [125.56521739,   3.2       ,   0.97391304,  16.24782609,
         20.43043478]])
```

In [72]:

```
plt.figure(figsize=(15,7))
plt.scatter(X[y == 0, 0], X[y == 0, 1], s = 20, c = 'b', label = 'Cluster 1')        #
plt.scatter(X[y == 1, 0], X[y == 1, 1], s = 20, c = 'Orange', label = 'Cluster 2')   #
plt.scatter(X[y == 2, 0], X[y == 2, 1], s = 20, c = 'Green', label = 'Cluster 3')    #
plt.scatter(centers[:, 0], centers[:, 1], s = 120, c = 'Red', label = 'Centroids',marker =
plt.title('Thyroid Gland Classification',fontsize=15)
plt.legend(title = 'Cluster')
plt.show()
```



In [73]:

```
from sklearn.metrics import classification_report, confusion_matrix     #importin classific
from sklearn import metrics
```

In [74]:

```
print(classification_report(clusters,z))                    #printing the classification report
```

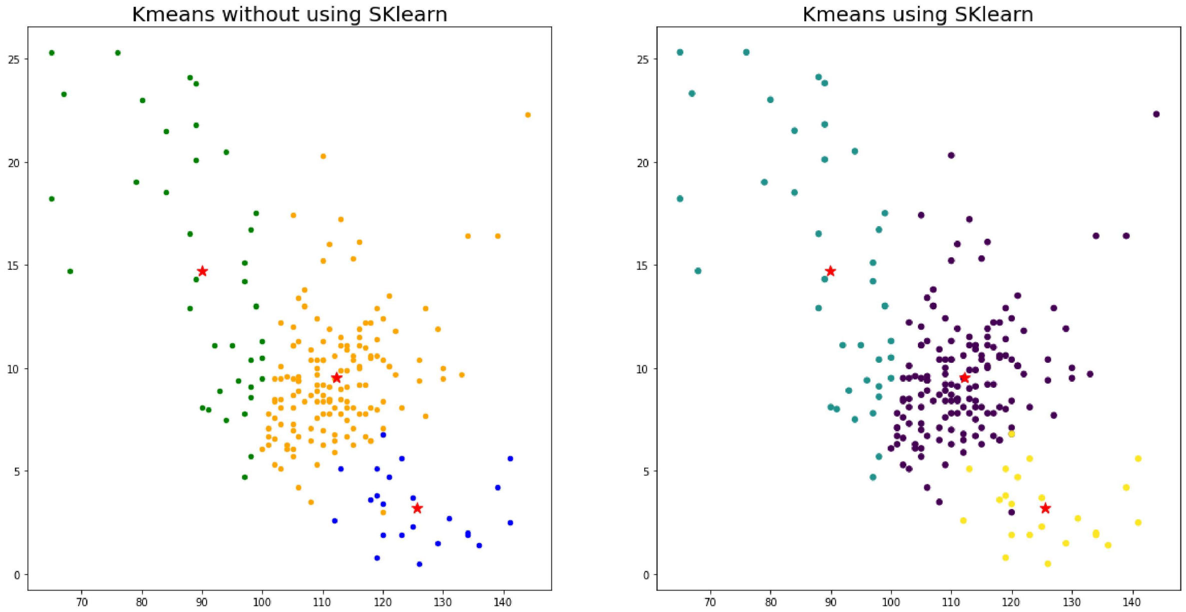
```
              precision    recall  f1-score   support

           0       0.91      0.89      0.90       152
           1       0.71      0.64      0.68        39
           2       0.77      1.00      0.87        23

    accuracy                           0.86       214
   macro avg       0.80      0.85      0.82       214
weighted avg       0.86      0.86      0.86       214
```

In [75]:

```
fig, axes = plt.subplots(1, 2, figsize=(20,10))
color=['green','orange','blue']
labels=['cluster1','cluster2','cluster3']
for k in range(K):
    axes[0].scatter(Output[k+1][:,0],Output[k+1][:,1],c=color[k],label=labels[k],s=20)
axes[0].scatter(Centroids[0,:],Centroids[1,:],s=120,c='red',label='Centroids',marker='*')
axes[0].set_title("Kmeans without using SKlearn",fontsize=20)
axes[1].scatter(X[:, 0], X[:, 1], c=clusters, s=30)
axes[1].scatter(centers[:,0],centers[:,1],marker="*",color="red",s=120)
axes[1].set_title("Kmeans using SKlearn",fontsize=20)
```

Out[75]:

```
Text(0.5, 1.0, 'Kmeans using SKlearn')
```



In [ ]: