Practical 4

Write A Program To Implement K_Means Using Python

In [125]:

```
import numpy as np
import random
import matplotlib.pyplot as plt
%matplotlib inline
```

In [126]:

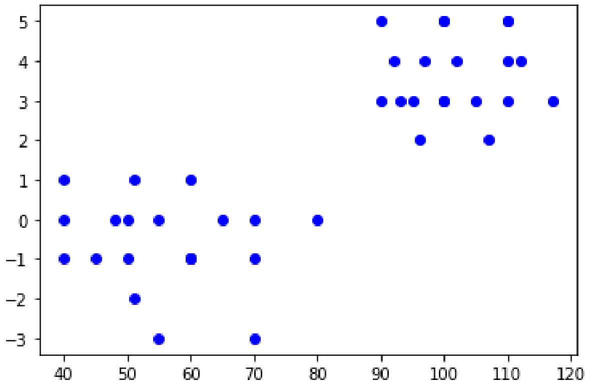
```
X = [[100,5], [90,5], [110,5], [97,4], [102,4], [112,4], [92,4], [95,3], [90,3], [100,3],
     [110,5], [100,5], [110,4], [93,3], [107,2], [117,3], [96,2], [105,3], [100,3], [110,3],
     [60,-1], [70,-1],[40,1], [70,-3], [50,-1], [80,0],[50,0],[60,-1],[60,1],[55,0],
     [40,-1], [45,-1],[40,0], [55,-3], [60,-1], [65,0],[70,0],[51,-2],[51,1],[48,0]]
```

In [127]:

```
plotx = []
ploty = []
for i in range(len(X)):
    plotx.append(X[i][0])
    ploty.append(X[i][1])
plt.plot(plotx,ploty, 'bo')
```

Out[127]:

```
[<matplotlib.lines.Line2D at 0x7f2fe00c7cd0>]
```



In [128]:

```
def random_centers(dim,k):
    centers = []
    for i in range(k):
        center = []
        for d in range(dim):
            rand = random.randint(0,100)
            center.append(rand)
        centers.append(center)
    return centers

def point_clustering(data, centers, dims, first_cluster=False):
    for point in data:
        nearest_center = 0
        nearest_center_dist = None
        for i in range(0, len(centers)):
            euclidean_dist = 0
            for d in range(0, dims):
                dist = abs(point[d] - centers[i][d])
                euclidean_dist += dist
            euclidean_dist = np.sqrt(euclidean_dist)
            if nearest_center_dist == None:
                nearest_center_dist = euclidean_dist
                nearest_center = i
            elif nearest_center_dist > euclidean_dist:
                nearest_center_dist = euclidean_dist
                nearest_center = i
        if first_cluster:
            point.append(nearest_center)
        else:
            point[-1] = nearest_center
    return data

def mean_center(data, centers, dims):
    print('centers:', centers, 'dims:', dims)
    new_centers = []
    for i in range(len(centers)):
        new_center = []
        n_of_points = 0
        total_of_points = []
        for point in data:
            if point[-1] == i:
                n_of_points += 1
                for dim in range(0,dims):
                    if dim < len(total_of_points):
                        total_of_points[dim] += point[dim]
                    else:
                        total_of_points.append(point[dim])
        if len(total_of_points) != 0:
            for dim in range(0,dims):
                print(total_of_points, dim)
                new_center.append(total_of_points[dim]/n_of_points)
            new_centers.append(new_center)
        else:
            new_centers.append(centers[i])


    return new_centers
```

In [129]:

```
def train_k_means_clustering(data, k=2, epochs=5):
    dims = len(data[0])
    print('data[0]:',data[0])
    centers = random_centers(dims,k)

    clustered_data = point_clustering(data, centers, dims, first_cluster=True)

    for i in range(epochs):
        centers = mean_center(clustered_data, centers, dims)
        clustered_data = point_clustering(data, centers, dims, first_cluster=False)

    return centers

def predict_k_means_clustering(point, centers):
    dims = len(point)
    center_dims = len(centers[0])

    if dims != center_dims:
        raise ValueError('Point given for prediction have', dims, 'dimensions but centers have', ce
nter_dims, 'dimensions')

    nearest_center = None
    nearest_dist = None

    for i in range(len(centers)):
        euclidean_dist = 0
        for dim in range(1, dims):
            dist = point[dim] - centers[i][dim]
            euclidean_dist += dist**2
        euclidean_dist = np.sqrt(euclidean_dist)
        if nearest_dist == None:
            nearest_dist = euclidean_dist
            nearest_center = i
        elif nearest_dist > euclidean_dist:
            nearest_dist = euclidean_dist
            nearest_center = i
        print('center:',i, 'dist:',euclidean_dist)

    return nearest_center
```

In [130]:

```
centers = train_k_means_clustering(X, k=2, epochs=5)
```

```
data[0]: [100, 5]
centers: [[12, 61], [89, 72]] dims: 2
[525, -6] 0
[525, -6] 1
[2631, 67] 0
[2631, 67] 1
centers: [[47.72727272727273, -0.5454545454545454], [90.72413793103448, 2.310344827586207]] dims:
2
[1040, -12] 0
[1040, -12] 1
[2116, 73] 0
[2116, 73] 1
centers: [[54.73684210526316, -0.631578947368421], [100.76190476190476, 3.4761904761904763]] dims:
2
[1040, -12] 0
[1040, -12] 1
[2116, 73] 0
[2116, 73] 1
centers: [[54.73684210526316, -0.631578947368421], [100.76190476190476, 3.4761904761904763]] dims:
2
[1040, -12] 0
[1040, -12] 1
[2116, 73] 0
[2116, 73] 1
centers: [[54.73684210526316, -0.631578947368421], [100.76190476190476, 3.4761904761904763]] dims:
2
[1040, -12] 0
[1040, -12] 1
[2116, 73] 0
[2116, 73] 1
```

In [131]:

```
print(centers)
```

```
[[54.73684210526316, -0.631578947368421], [100.76190476190476, 3.4761904761904763]]
```

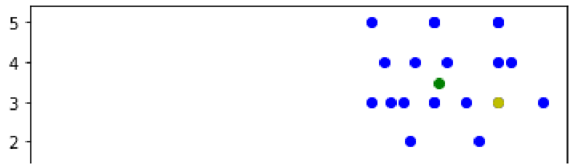
In [132]:

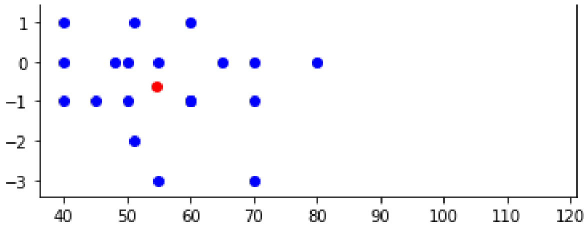
```
point = [110,3]
print(predict_k_means_clustering(point, centers))

plt.plot(plotx,ploty, 'bo', centers[0][0], centers[0][1],'ro', centers[1][0], centers[1][1], 'go',
point[0], point[1], 'yo')
```

```
center: 0 dist: 3.6315789473684212
center: 1 dist: 0.4761904761904763
1
```

Out[132]:

```
[<matplotlib.lines.Line2D at 0x7f2fe0051370>,
 <matplotlib.lines.Line2D at 0x7f2fe0051460>,
 <matplotlib.lines.Line2D at 0x7f2fe0051310>,
 <matplotlib.lines.Line2D at 0x7f2fe0051670>]
```




1
0
−1
−2
−3
40
50
60
70
80
90
100
110
120