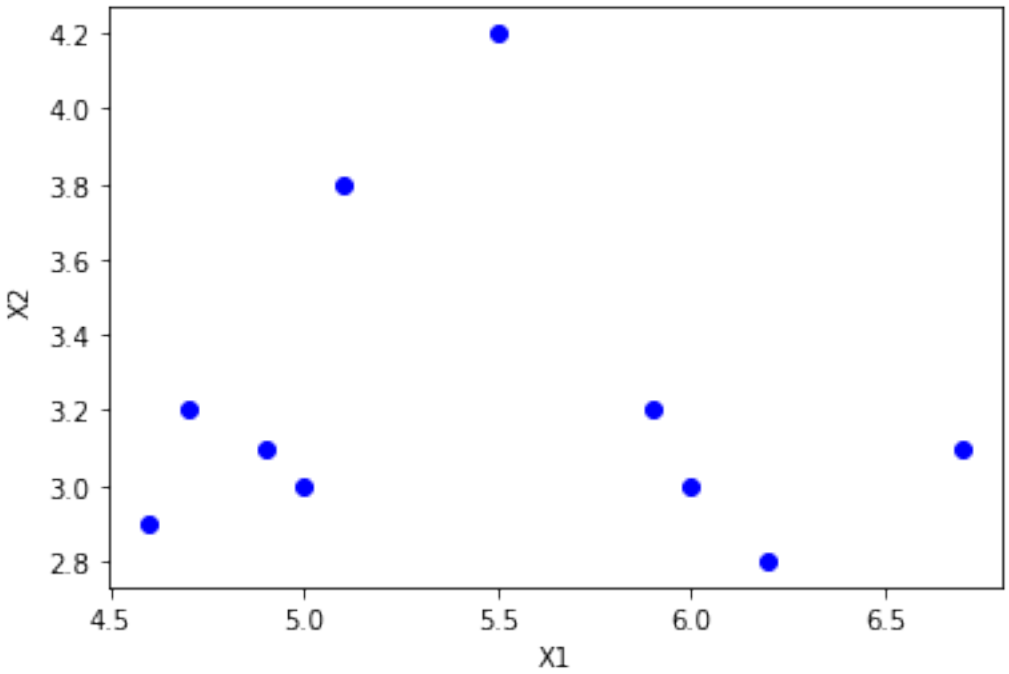
```
import pandas as pd
data = pd.read_csv('kmeans.csv')
```

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
from matplotlib.colors import ListedColormap
%matplotlib inline
```

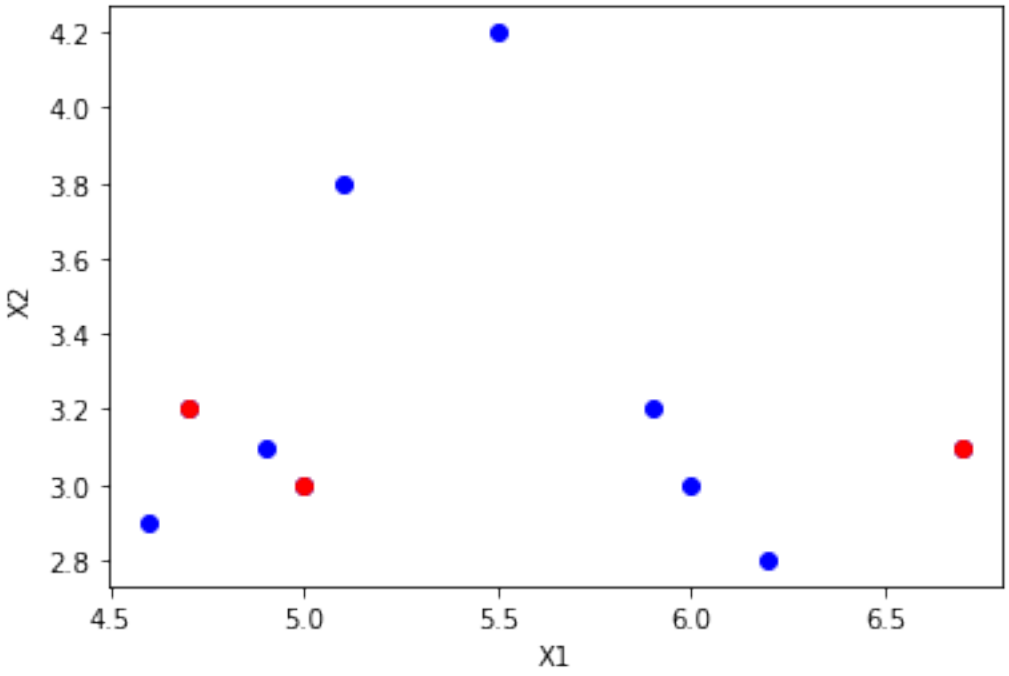
```
data = pd.read_csv('kmeans.csv')
colnames = list(data.columns[1:-1])
data.head()
```

```
    X1   X2
0  5.9  3.2
1  4.6  2.9
2  6.2  2.8
3  4.7  3.2
4  5.5  4.2
```

```
X = data[["X1", "X2"]]
# Visualize data point
plt.scatter(X["X1"], X["X2"], c="blue")
plt.xlabel("X1")
plt.ylabel("X2")
plt.show()
```



```
# number of centriod
K=3

# select random observation as a centriod
Centroids = (X.sample(n=K))
plt.scatter(X["X1"], X["X2"], c="blue")
plt.scatter(Centroids["X1"], Centroids["X2"], c="red")
plt.xlabel("X1")
plt.ylabel("X2")
plt.show()
```




```
Centroids
```

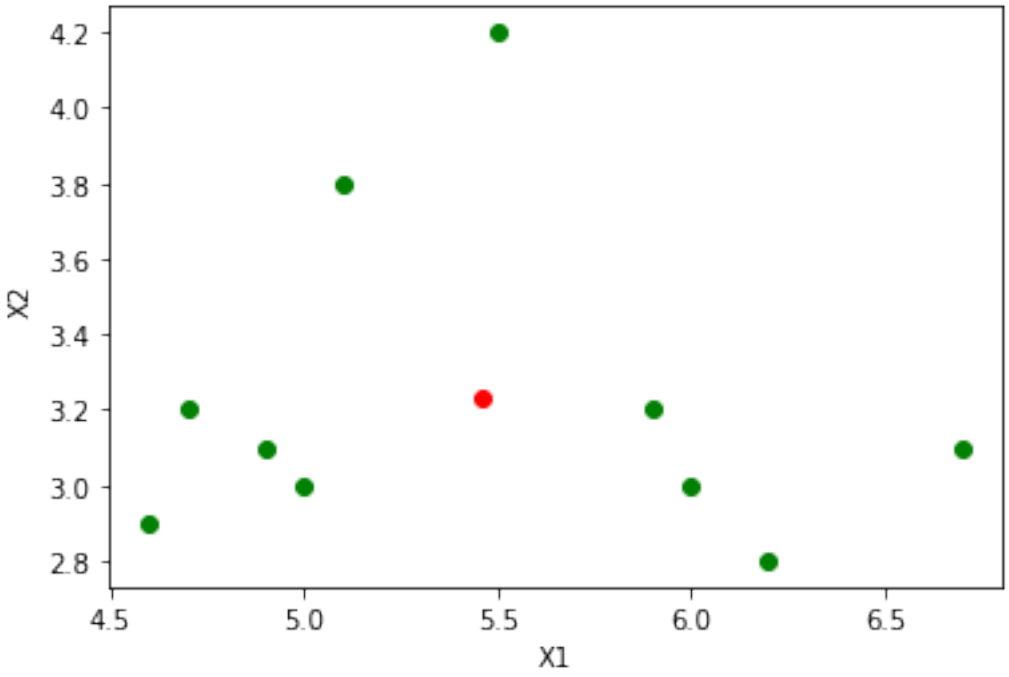
```
    X1   X2
3  4.7  3.2
5  5.0  3.0
7  6.7  3.1
```

```
# Step 3 - Assign all the points to the closest cluster centroid
# Step 4 - Recompute centroids of newly formed clusters
# Step 5 - Repeat step 3 and 4
from math import sqrt

diff = 1
j=0

while(diff!=0):
    XD=X
    i=1
```

```
    for index1, row_c in Centroids.iterrows():
        ED=[]
        for index2, row_d in XD.iterrows():
            d1 = (row_c["X1"]-row_d["X2"])**2
            d2 = (row_c["X2"]-row_d["X2"])**2
            d = sqrt(d1+d2)
            ED.append(d)
        X[i] = ED
        i = i+1

    C = []
    for index, row in X.iterrows():
        min_dist=row[1]
        pos=1
        for i in range(K):
            if row[i+1] < min_dist:
                min_dist = row[i+1]
                pos = i+1
        C.append(pos)
    X["Cluster"]=C
    Centroids_new = X.groupby(["Cluster"]).mean()[["X2", "X1"]]
    if j == 0:
        diff = 1
        j = j+1
    else:
        diff = (Centroids_new['X2'] - Centroids['X2']).sum() +
(Centroids_new['X1'] - Centroids['X1']).sum()
        print(diff.sum())
    Centroids = X.groupby(["Cluster"]).mean()[["X2","X1"]]
```

```
0.0
```

```
color=['blue','green','cyan']
for k in range(K):
    data=X[X["Cluster"]==k+1]
    plt.scatter(data["X1"],data["X2"],c=color[k])
plt.scatter(Centroids["X1"],Centroids["X2"],c='red')
plt.xlabel('X1')
plt.ylabel('X2')
plt.show()
```


4.2
4.0
3.8
3.6
3.4
3.2
3.0
2.8
X2
4.5
5.0
5.5
6.0
6.5
X1