```python
# Import libraries
import numpy as np
import pandas as pd
from scipy.spatial.distance import cdist


import numpy as np

# Data points
points = np.array([
    [5, 7], [15, 12], [16, 18], [6, 6], [16, 11], [15, 11], [6, 4],
    [13, 13], [16, 17], [5, 5], [15, 17], [16, 17], [6, 8], [14, 12], [16, 15]
])

# Initial centroids (orange points)
centroids = np.array([
    [5, 12],    # Cluster 0
    [15, 4],    # Cluster 1
    [10, 17]    # Cluster 2
], dtype=float)

# Perform 3 iterations of the k-means algorithm
for iteration in range(3):
    print(f"\n--- Iteration {iteration + 1} ---")

    # Store the cluster assignment for each point
    labels = []

    for i, point in enumerate(points):
        # List to store distance from this point to each centroid
        distances = []

        for j, centroid in enumerate(centroids):
            # Calculate Euclidean distance
            distance = np.sqrt((point[0] - centroid[0])**2 + (point[1] - centroid[1])**2)
            distances.append(distance)

        # Find cluster number of the nearest centroid
        nearest_cluster = np.argmin(distances)
        labels.append(nearest_cluster)

        # assignment the point to cluster
        print(f"Point {point} assigned to Cluster {nearest_cluster}")

    # Recalculate centroids based on assigned points
    for k in range(len(centroids)):
        # Get all points assigned to cluster k
        cluster_points = [points[i] for i in range(len(points)) if labels[i] == k]

        if cluster_points:
            # Calculate new centroid as the average of the cluster's points
            new_centroid = np.mean(cluster_points, axis=0)
            centroids[k] = new_centroid

        # Print new centroid coordinates
        print(f"New Centroid {k}: {centroids[k]}")
```

```
Point [5 7] assigned to Cluster 0
Point [15 12] assigned to Cluster 2
Point [16 18] assigned to Cluster 2
Point [6 6] assigned to Cluster 0
Point [16 11] assigned to Cluster 1
Point [15 11] assigned to Cluster 1
Point [6 4] assigned to Cluster 0
Point [13 13] assigned to Cluster 2
Point [16 17] assigned to Cluster 2
Point [5 5] assigned to Cluster 0
Point [15 17] assigned to Cluster 2
Point [16 17] assigned to Cluster 2
Point [6 8] assigned to Cluster 0
Point [14 12] assigned to Cluster 2
Point [16 15] assigned to Cluster 2
New Centroid 0: [5.6 6. ]
New Centroid 1: [15.5 11. ]
New Centroid 2: [15.125 15.125]

Point [5 7] assigned to Cluster 0
```

```
Point [5 7] assigned to Cluster 0
Point [15 12] assigned to Cluster 1
Point [16 18] assigned to Cluster 2
Point [6 6] assigned to Cluster 0
Point [16 11] assigned to Cluster 1
Point [15 11] assigned to Cluster 1
Point [6 4] assigned to Cluster 0
Point [13 13] assigned to Cluster 2
Point [16 17] assigned to Cluster 2
Point [5 5] assigned to Cluster 0
Point [15 17] assigned to Cluster 2
Point [16 17] assigned to Cluster 2
Point [6 8] assigned to Cluster 0
Point [14 12] assigned to Cluster 1
Point [16 15] assigned to Cluster 2
New Centroid 0: [5.6 6. ]
New Centroid 1: [15.  11.5]
New Centroid 2: [15.33333333 16.16666667]

--- Iteration 3 ---
Point [5 7] assigned to Cluster 0
Point [15 12] assigned to Cluster 1
Point [16 18] assigned to Cluster 2
Point [6 6] assigned to Cluster 0
Point [16 11] assigned to Cluster 1
Point [15 11] assigned to Cluster 1
Point [6 4] assigned to Cluster 0
Point [13 13] assigned to Cluster 1
Point [16 17] assigned to Cluster 2
Point [5 5] assigned to Cluster 0
Point [15 17] assigned to Cluster 2
Point [16 17] assigned to Cluster 2
Point [6 8] assigned to Cluster 0
Point [14 12] assigned to Cluster 1
Point [16 15] assigned to Cluster 2
New Centroid 0: [5.6 6. ]
New Centroid 1: [14.6 11.8]
New Centroid 2: [15.8 16.8]
```