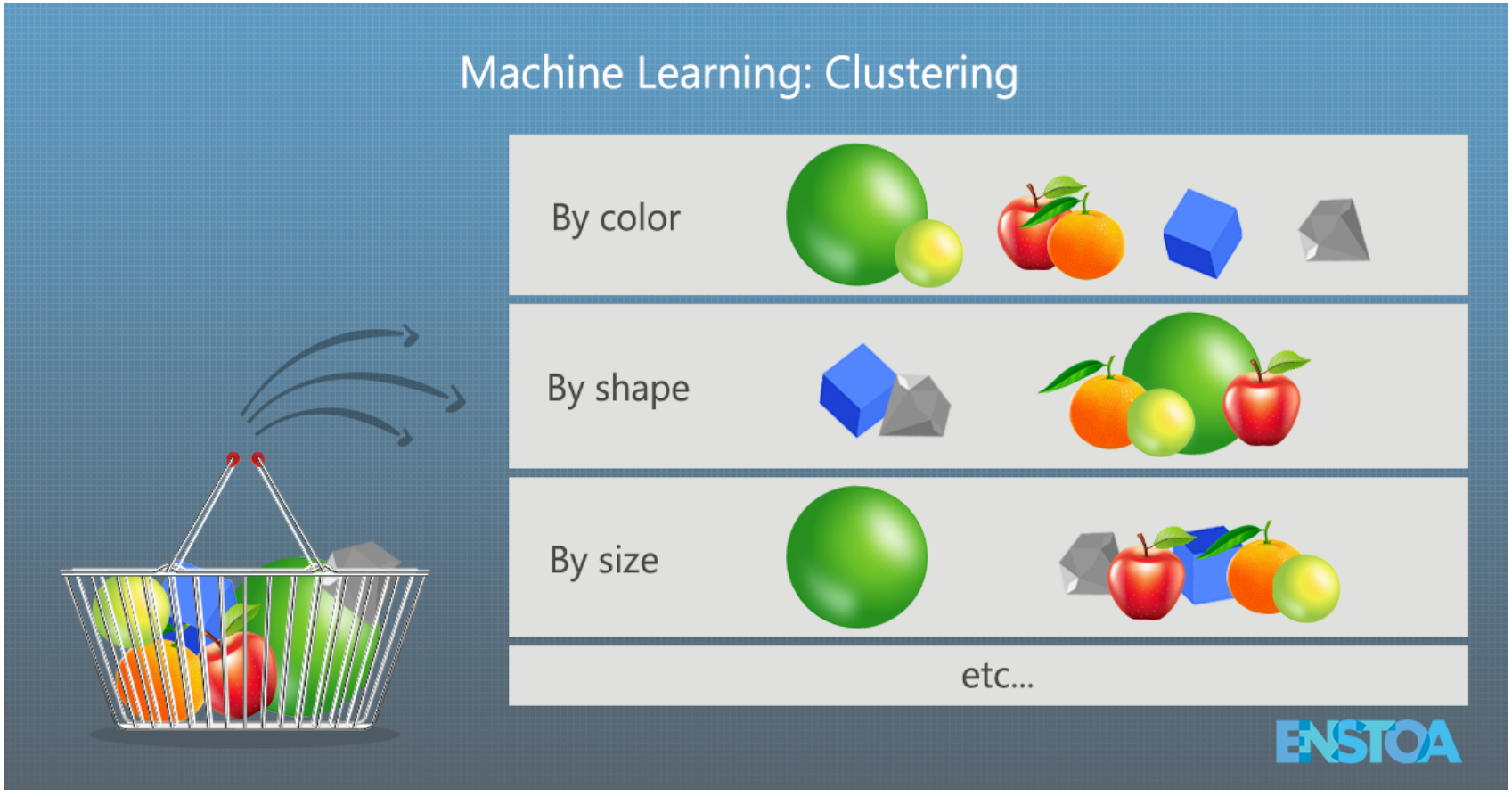
Clustering and K-means Clustering

What is clustering?

Clustering is grouping data points into groups where data points in one group are `similar` to each other.

What is clustering?



Methods of Clustering

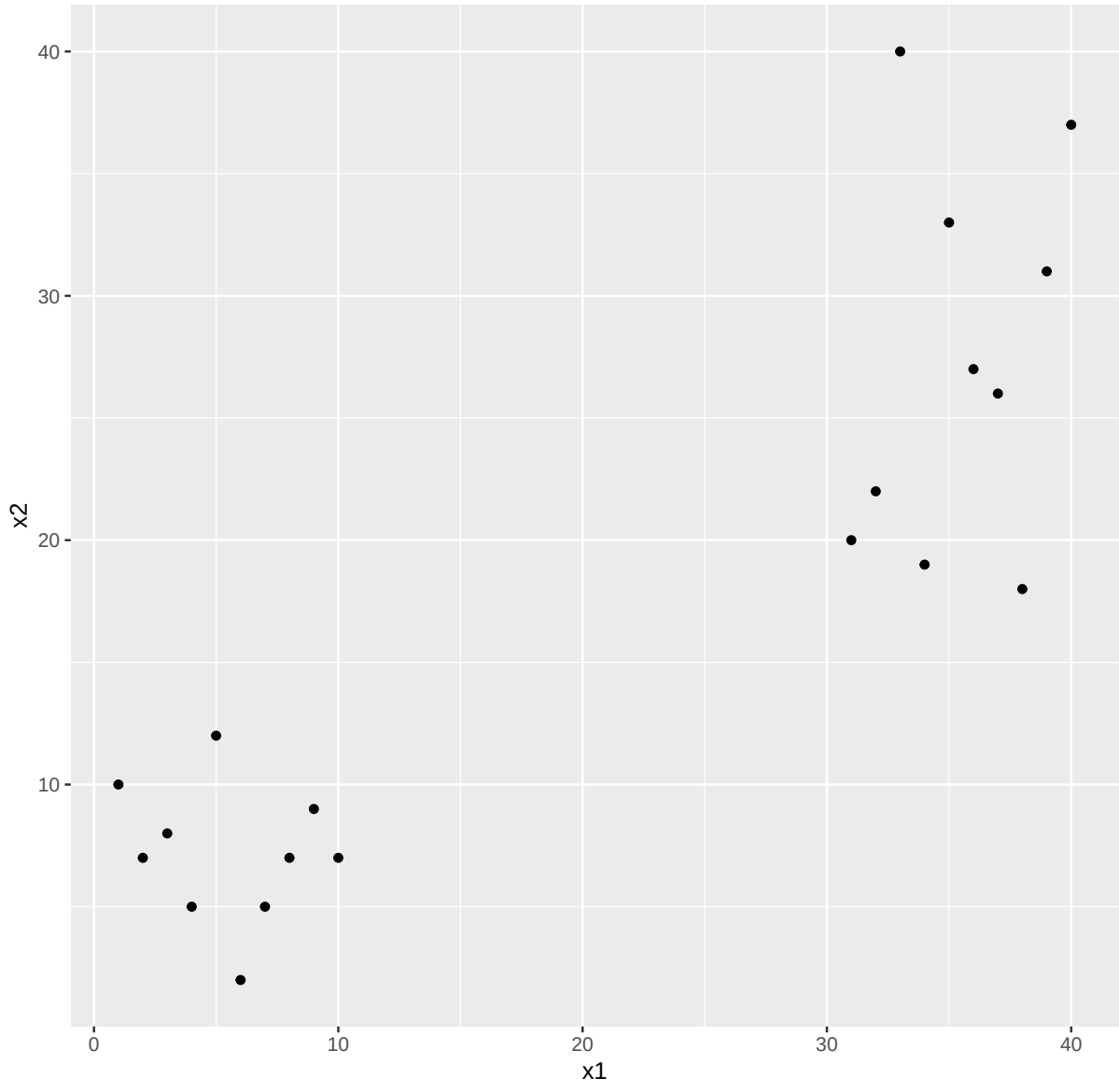
We will cover two clustering methods:

- K-means clustering and
- Hierarchical clustering

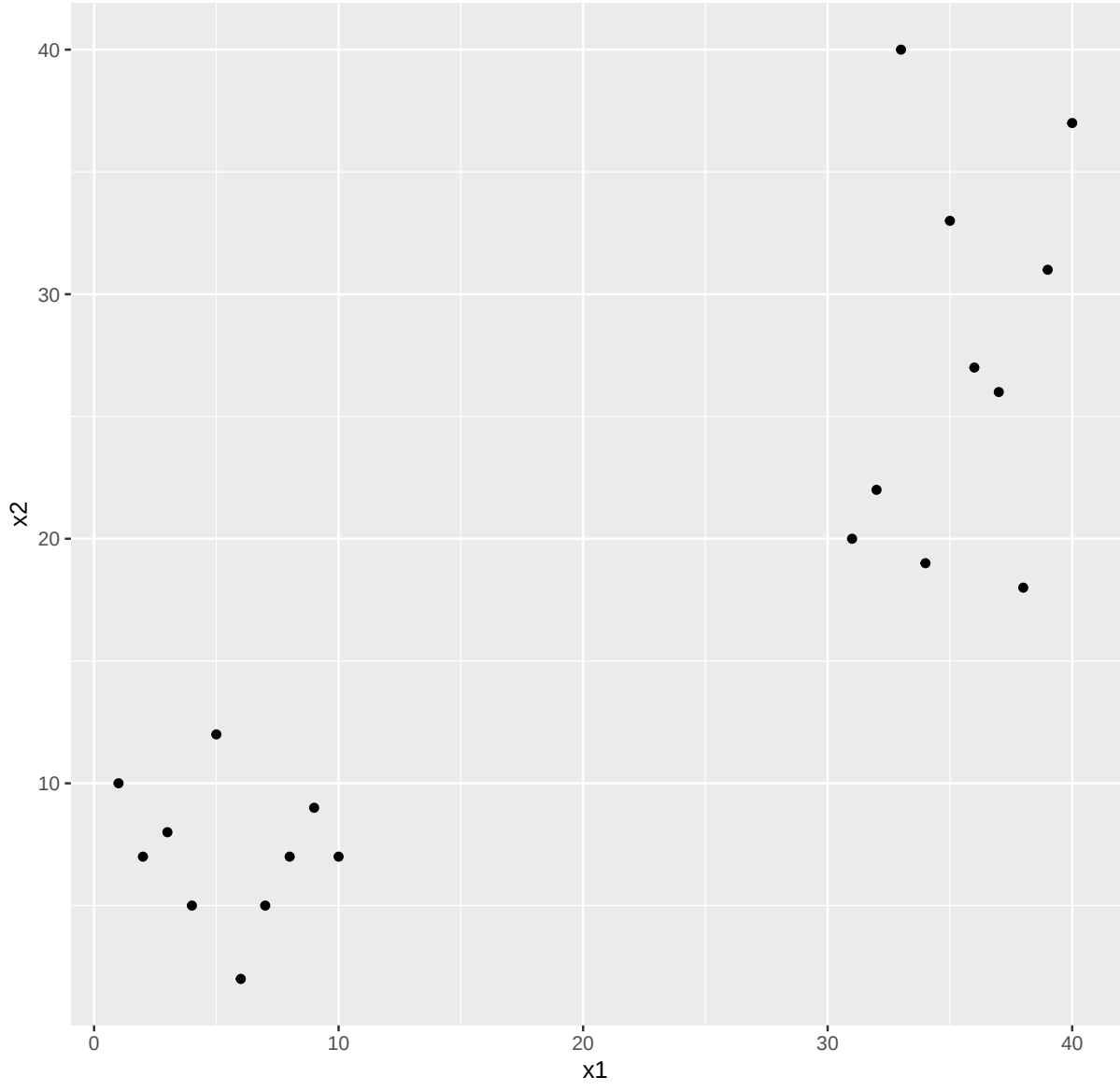
K-means Clustering

- Data
- Visualize Data
- Result of K-means clustering

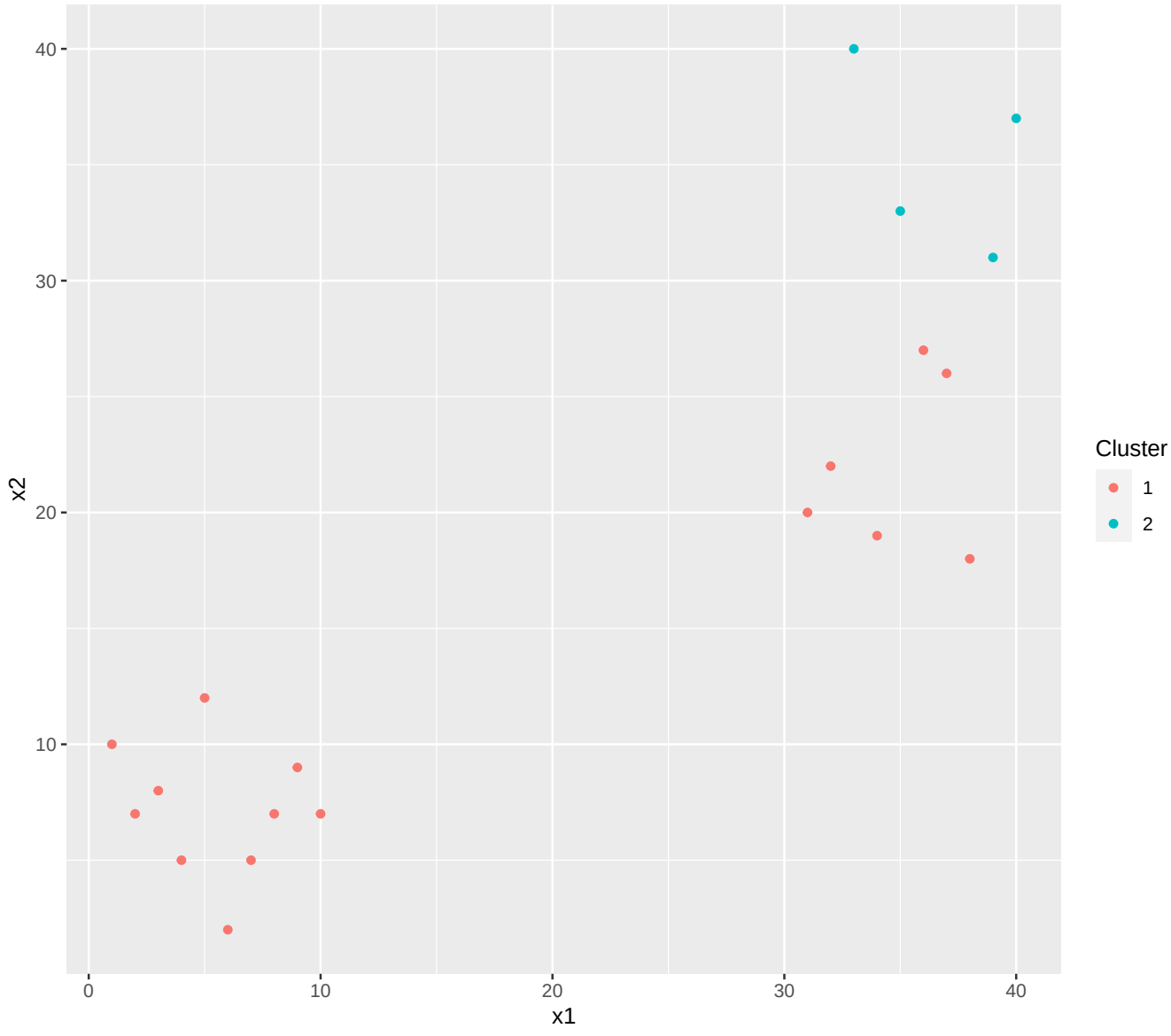
Step 1



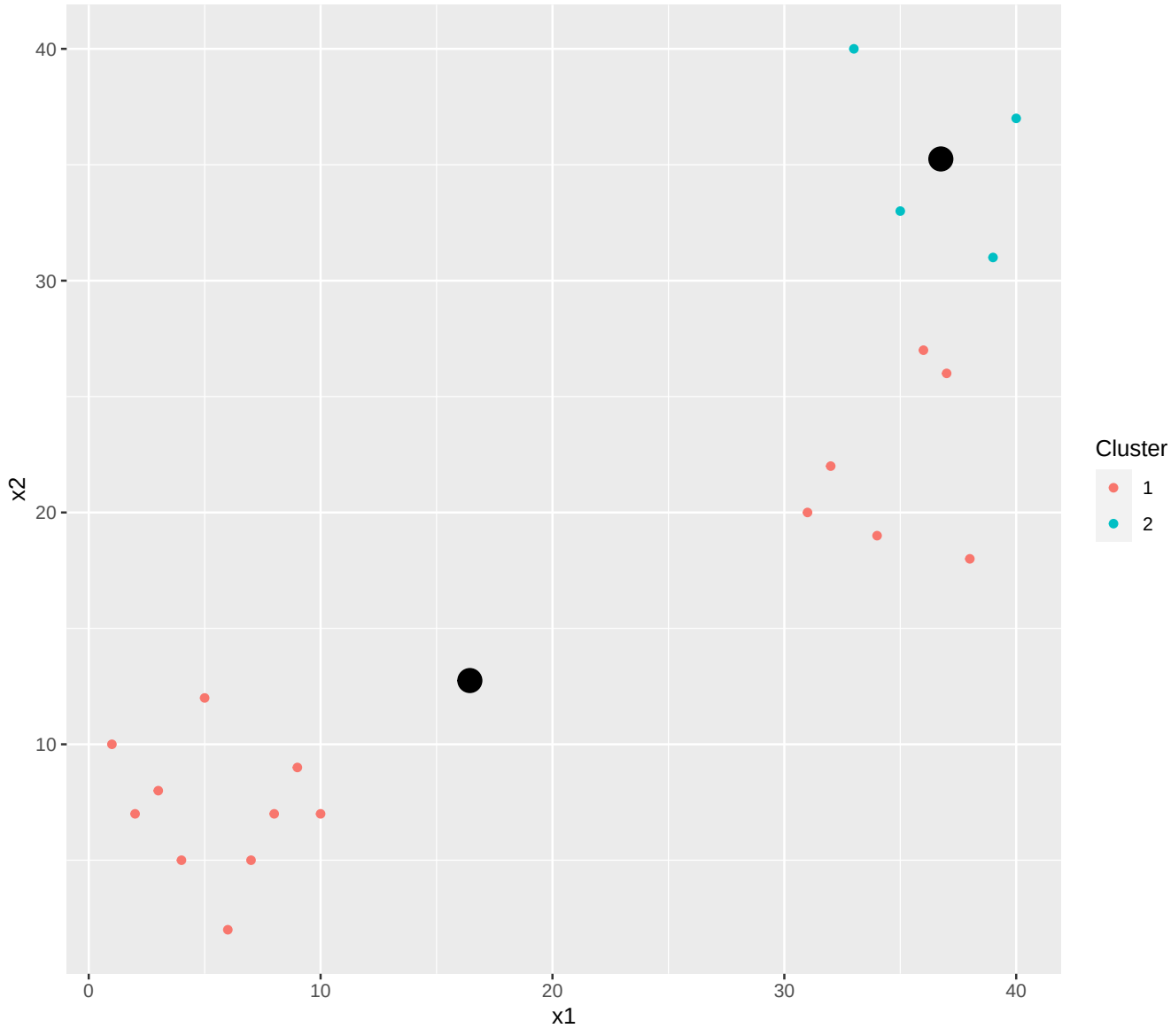
Step 1: Randomly select centroids



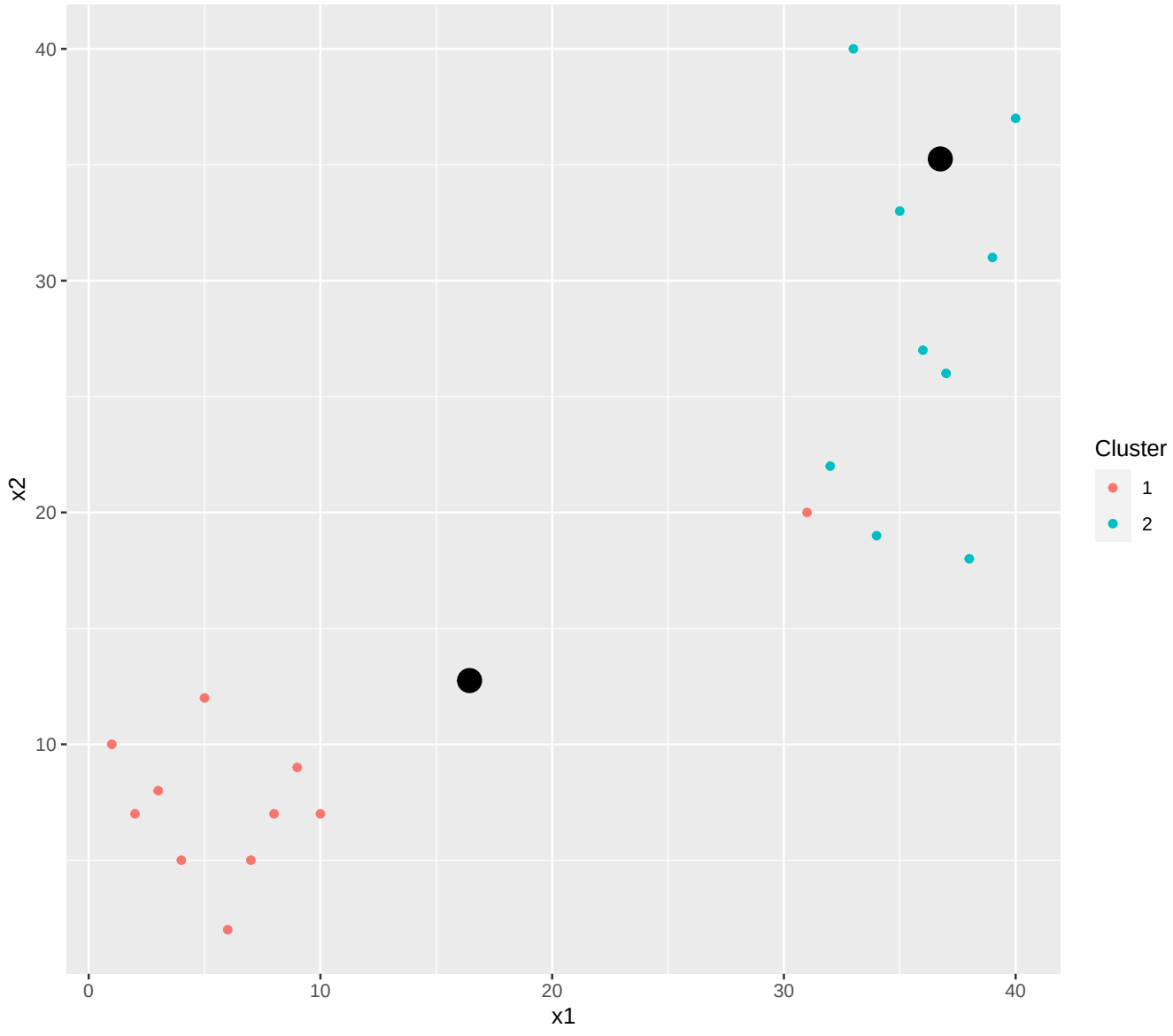
Step 1: Collect points for each clusters



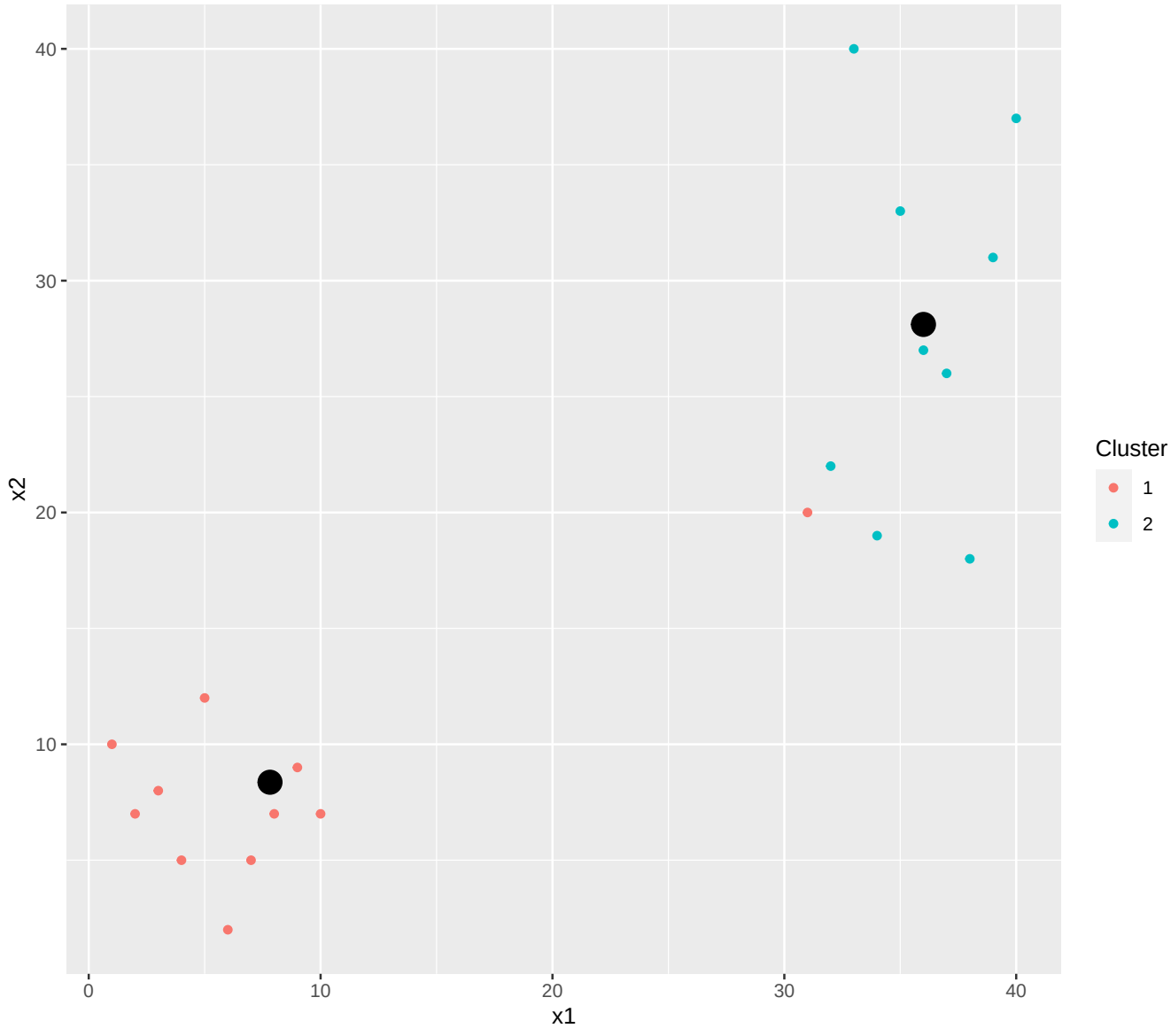
Locate centroids



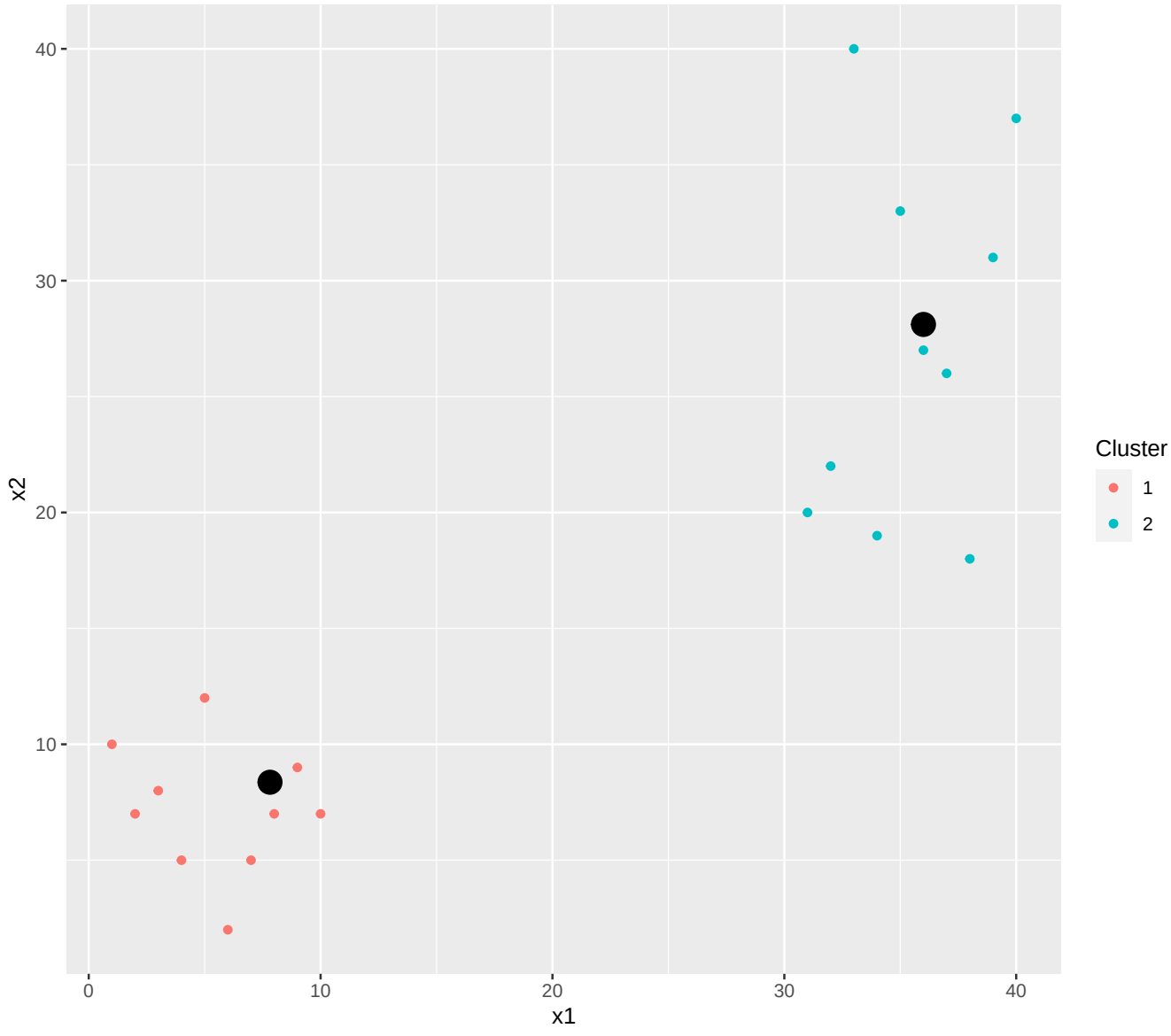
Collect points for each clusters



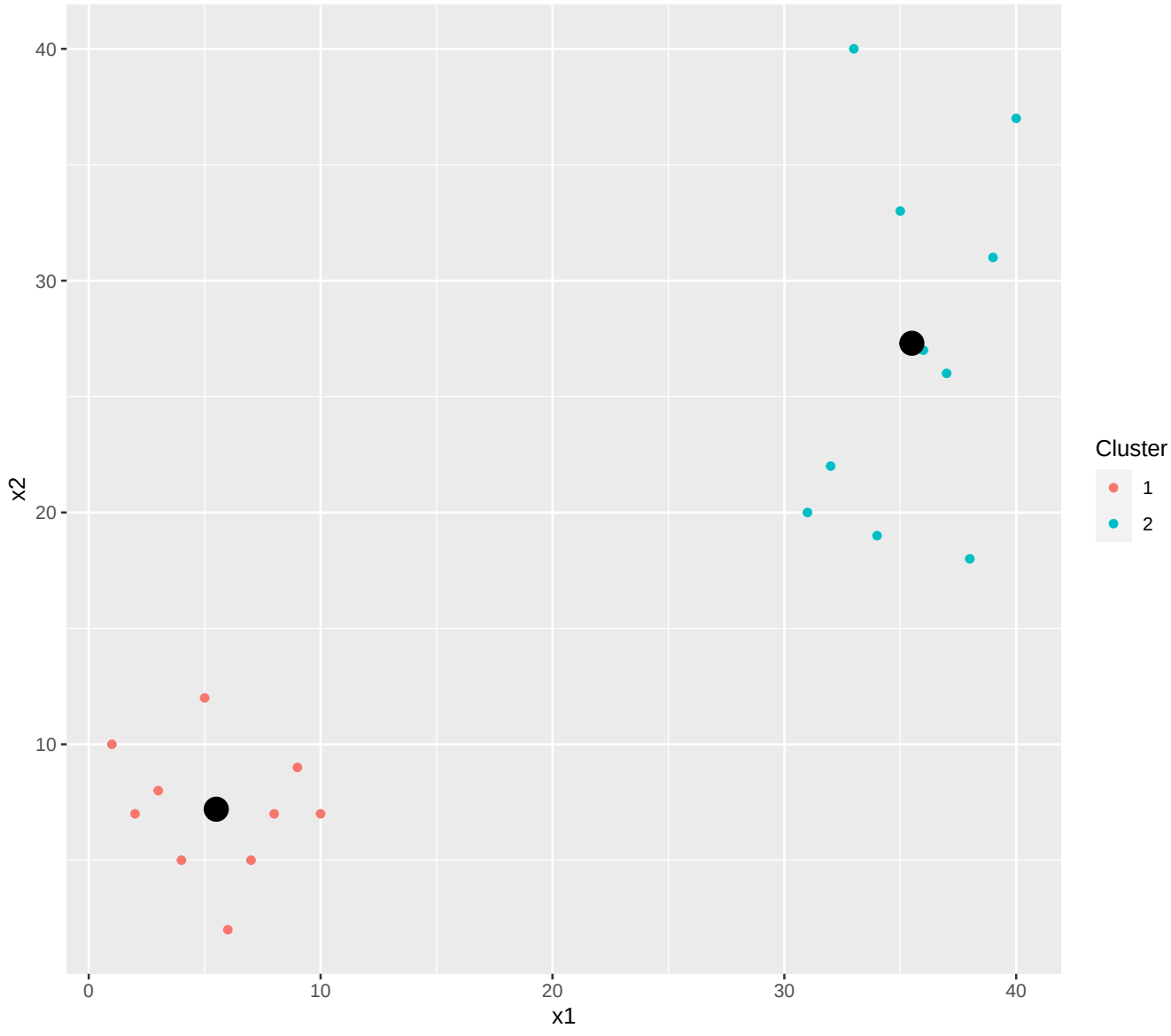
Relocate centroids



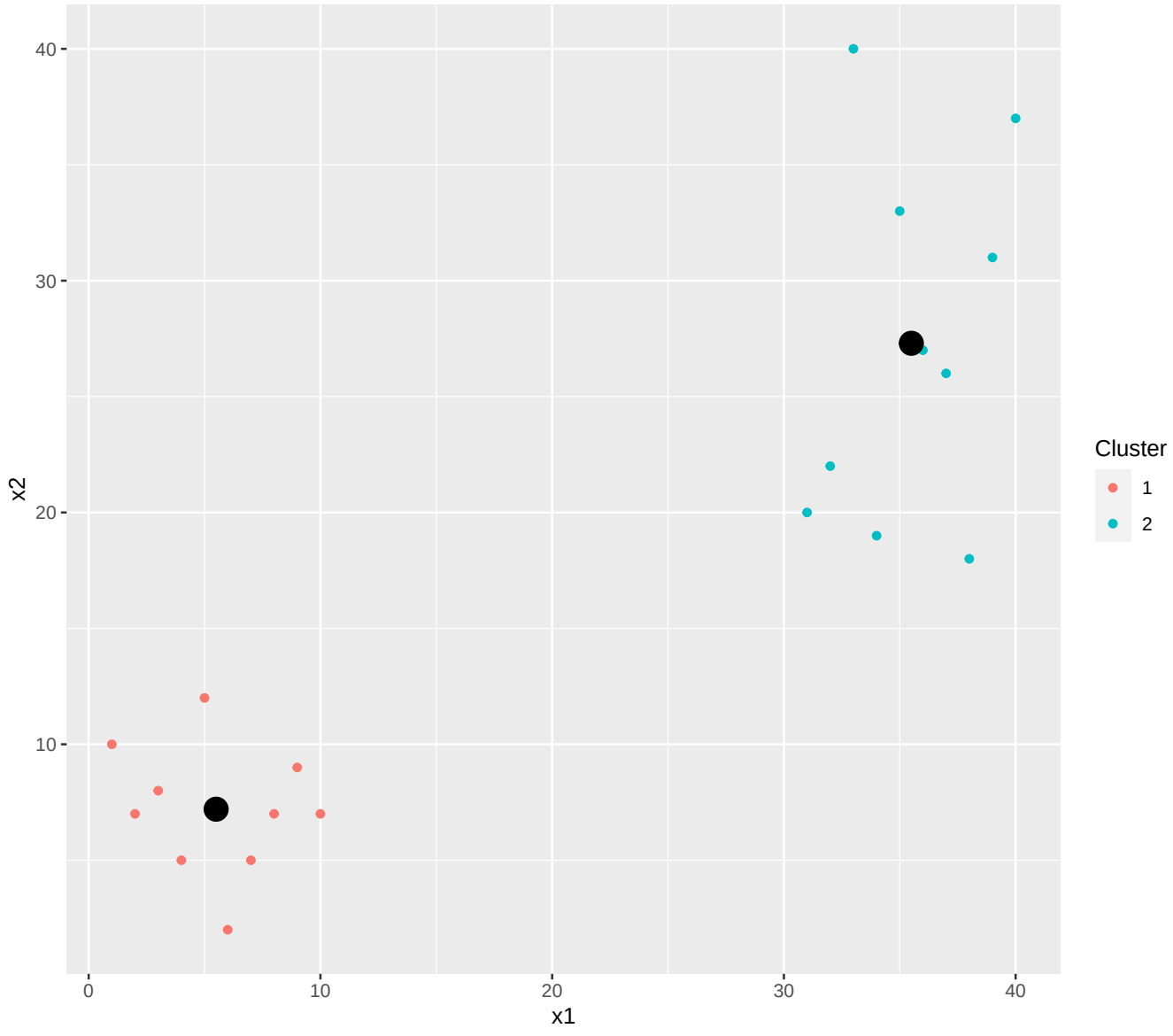
Collect points for each clusters



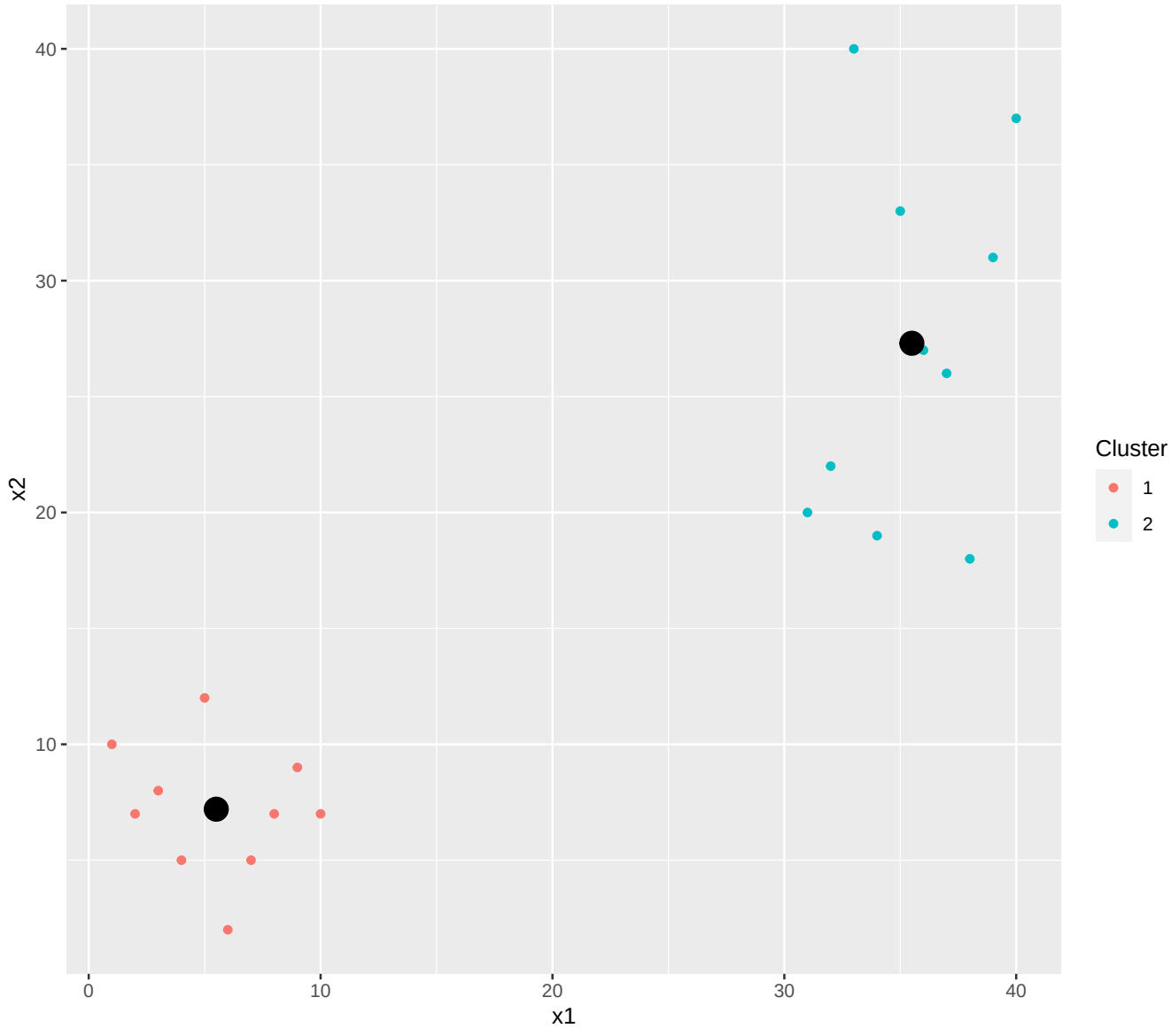
Relocate centroids



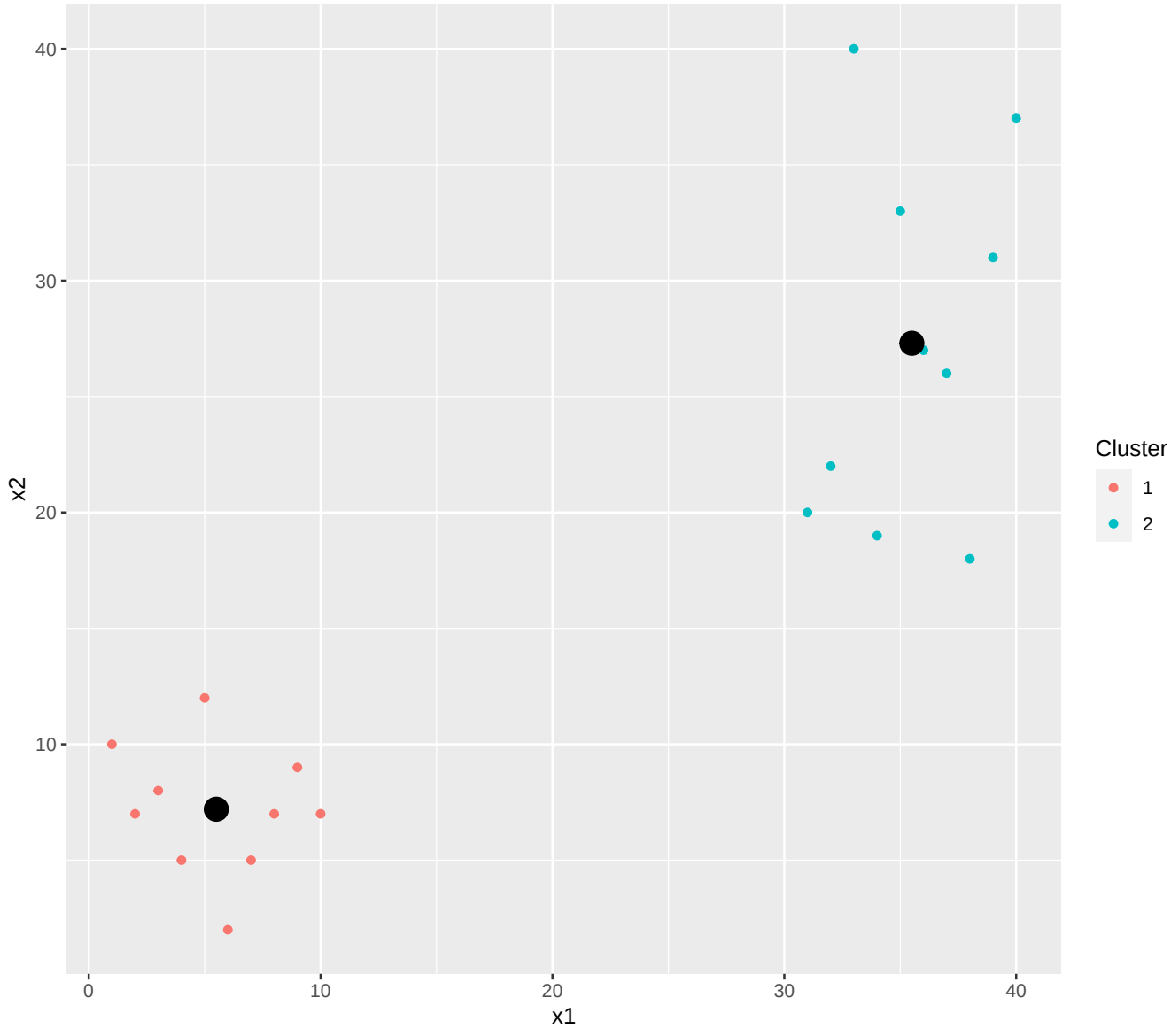
Collect points for each clusters



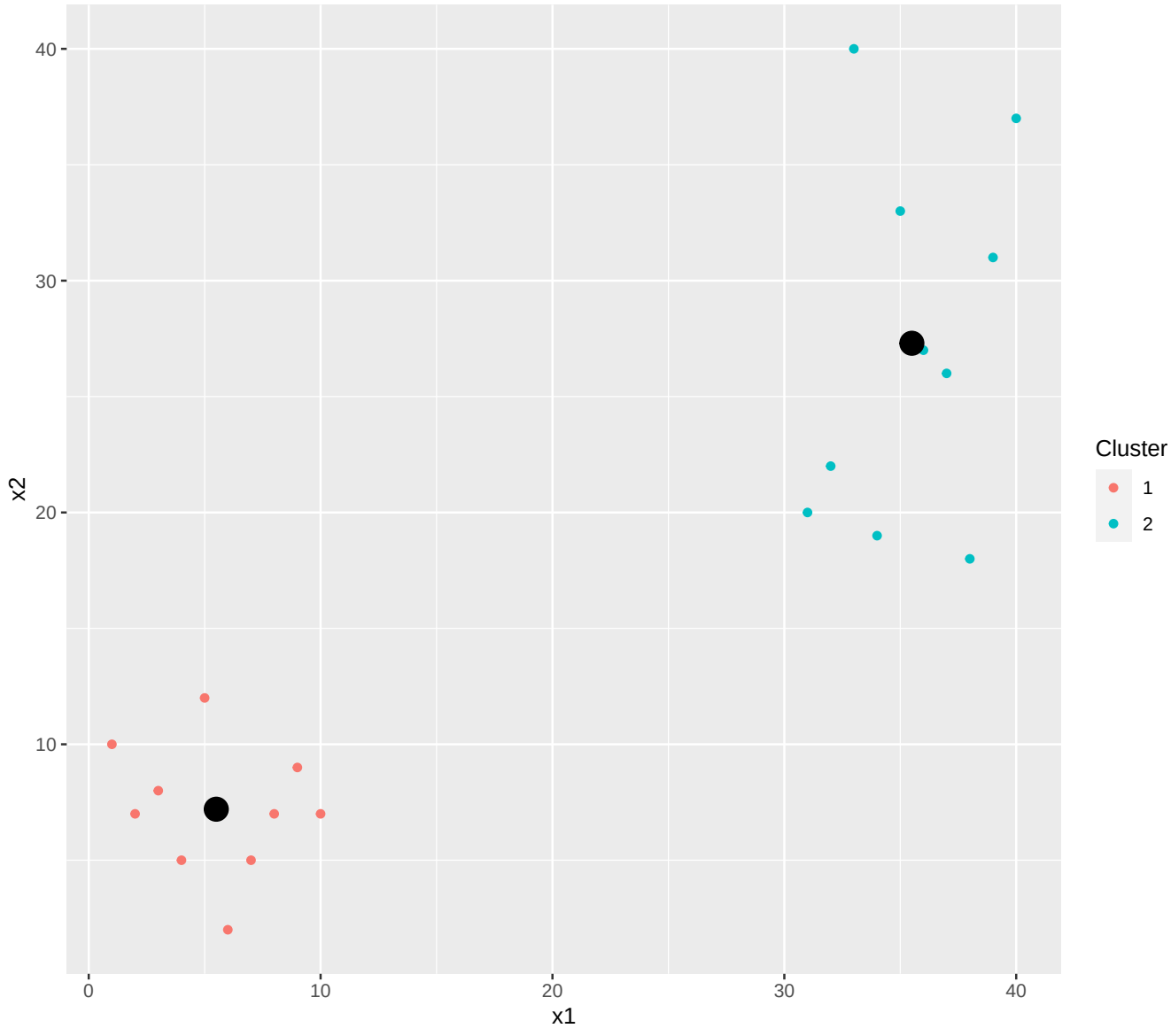
Relocate centroids



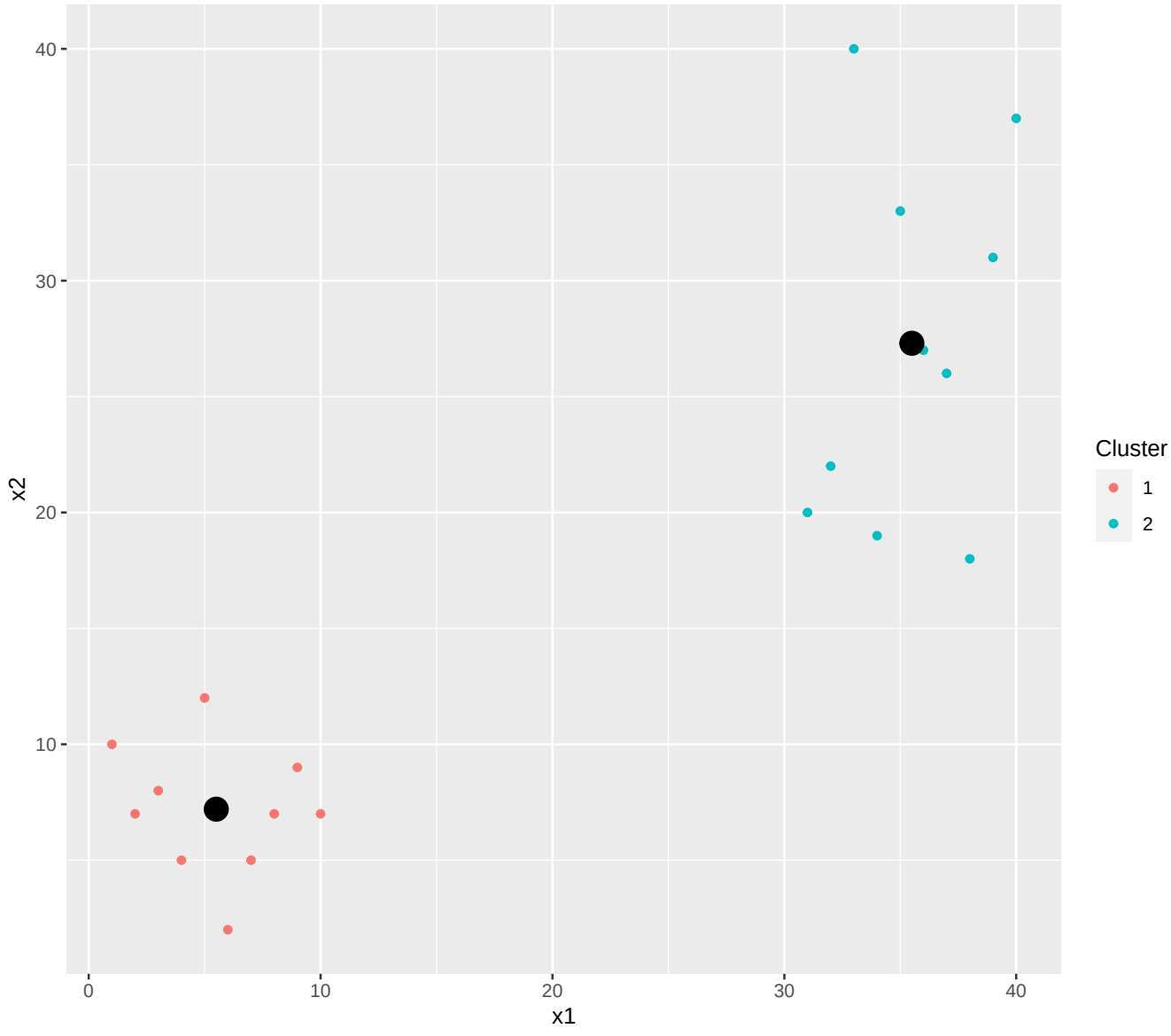
Step 2: Collect points for each clusters



Step 2: Relocate centroids



Step 2: Collect points for each clusters



Centroids

Cluster	x1	x2
1	5.5	7.2
2	35.5	27.3

K-means Algorithm

1. Randomly assign a number, from 1 to K, to each of the observations. These serve as initial cluster assignments for the observations.
2. Iterate until the cluster assignments stop changing:
   - (a) For each of the K clusters, compute the cluster centroid. The kth cluster centroid is the vector of the p feature means for the observations in the kth cluster.
   - (b) Assign each observation to the cluster whose centroid is closest (where closest is defined using Euclidean distance).

Dataset

Point	x	y
A	1	3
B	2	2
C	3	5
D	4	5
E	5	6

Randomly Assign Cluster to Points

Cluster	Point	x	y
1	A	1	3
2	B	2	2
1	C	3	5
1	D	4	5
2	E	5	6

Cluster	Point	x	y
1	A	1	3
2	B	2	2
1	C	3	5
1	D	4	5
2	E	5	6

- Total Variance within

Cluster	Point	x	y
1	A	1	3
2	B	2	2
1	C	3	5
1	D	4	5
2	E	5	6

- Total Variance within 19.83

Cluster	Point	x	y	C_1x	C_1y	C_2x	C_2y
1	A	1	3	2.67	4.33	3.5	4
2	B	2	2	2.67	4.33	3.5	4
1	C	3	5	2.67	4.33	3.5	4
1	D	4	5	2.67	4.33	3.5	4
2	E	5	6	2.67	4.33	3.5	4

Cluster	Point	x	y	C_1x	C_1y	C_2x	C_2y	dc1	dc2
1	A	1	3	2.67	4.33	3.5	4	2.13	2.69
2	B	2	2	2.67	4.33	3.5	4	2.42	2.50
1	C	3	5	2.67	4.33	3.5	4	0.75	1.12
1	D	4	5	2.67	4.33	3.5	4	1.49	1.12
2	E	5	6	2.67	4.33	3.5	4	2.87	2.50

Cluster	Point	x	y	dc1	dc2	min_distance
1	A	1	3	2.13	2.69	2.13
2	B	2	2	2.42	2.50	2.42
1	C	3	5	0.75	1.12	0.75
1	D	4	5	1.49	1.12	1.12
2	E	5	6	2.87	2.50	2.50

- Total Variance within

Cluster	Point	x	y	dc1	dc2	min_distance	New_Cluster
1	A	1	3	2.13	2.69	2.13	1
2	B	2	2	2.42	2.50	2.42	1
1	C	3	5	0.75	1.12	0.75	1
1	D	4	5	1.49	1.12	1.12	2
2	E	5	6	2.87	2.50	2.50	2

- Total Variance within 7.67