

**Example: Cluster the following eight points (with (x, y)) representing locations) into three clusters A1(2, 10), A2(2, 5), A3(8, 4), A4(5, 8), A5(7, 5), A6(6, 4), A7(1, 2), A8(4, 9)**

**Initial cluster centers are A1(2, 10), A4(5, 8), A7(1,2)**

*Note you can use rectilinear distance or Euclidean distance, this example is solved using rectilinear distance.*

**Solution:**

**- Iteration 1:**

	point	x	y	C1 (2, 10)	C2 (5, 8)	C3 (1, 2)	Cluster
A1	(2, 10)	2	10	0	5	9	1
A2	(2, 5)	2	5	5	6	4	3
A3	(8, 4)	8	4	12	7	9	2
A4	(5, 8)	5	8	5	0	10	2
A5	(7, 5)	7	5	10	5	9	2
A6	(6, 4)	6	4	10	5	7	2
A7	(1, 2)	1	2	9	10	0	3
A8	(4, 9)	4	9	3	2	10	2

- Cluster 1: (2, 10)
- Cluster 2: (8, 4), (5, 8), (7, 5), (6, 4), (4, 9)
- Cluster 3: (2, 5), (1, 2)

New Centroids after iteration 1:

- $C1 = (2, 10)$
- $C2 = ((8 + 5 + 7 + 6 + 4) / 5), (4 + 8 + 5 + 4 + 9) / 5) = (6, 6)$
- $C3 = ((2 + 1) / 2, (5 + 2) / 2) = (1.5, 3.5)$

**- Iteration 2:**

	point	x	y	C1 (2, 10)	C2 (6, 6)	C3 (1.5, 3.5)	Cluster
A1	(2, 10)	2	10	0	8	7	1
A2	(2, 5)	2	5	5	5	2	3
A3	(8, 4)	8	4	12	4	7	2
A4	(5, 8)	5	8	5	3	8	2
A5	(7, 5)	7	5	10	2	7	2
A6	(6, 4)	6	4	10	2	5	2
A7	(1, 2)	1	2	9	9	2	3
A8	(4, 9)	4	9	3	5	8	1

- Cluster 1: (2, 10), (4, 9)
- Cluster 2: (8, 4), (5, 8), (7, 5), (6, 4)
- Cluster 3: (2, 5), (1, 2)

New Centroids after iteration 2:

- $C1 = ((2 + 4) / 2), (10 + 9) / 2) = (3, 9.5)$
- $C2 = ((8 + 5 + 7 + 6) / 4), (4 + 8 + 5 + 4) / 4) = (6.5, 5.25)$
- $C3 = ((2 + 1) / 2), (5 + 2) / 2) = (1.5, 3.5)$

#### - Iteration 3:

	point	x	y	C1 (3, 9.5)	C2 (6.5, 5.25)	C3 (1.5, 3.5)	Cluster
A1	(2, 10)	2	10	1.5	9.25	7	1
A2	(2, 5)	2	5	5.5	4.75	2	3
A3	(8, 4)	8	4	10.5	2.75	7	2
A4	(5, 8)	5	8	3.5	4.25	8	1
A5	(7, 5)	7	5	8.5	0.75	7	2
A6	(6, 4)	6	4	8.5	1.75	5	2
A7	(1, 2)	1	2	9.5	8.75	2	3
A8	(4, 9)	4	9	1.5	6.25	8	1

- Cluster 1: (2, 10), (5, 8), (4, 9)
- Cluster 2: (8, 4), (7, 5), (6, 4)
- Cluster 3: (2, 5), (1, 2)

New Centroids after iteration 3:

- $C1 = ((2 + 5 + 4) / 3), (10 + 8 + 9) / 3) = (3.67, 9)$
- $C2 = ((8 + 7 + 6) / 3), (4 + 5 + 4) / 3) = (7, 4.3)$
- $C3 = ((2 + 1) / 2), (5 + 2) / 2) = (1.5, 3.5)$

#### - Iteration 4:

	point	x	y	C1 (3.67, 9)	C2 (7, 4.3)	C3 (1.5, 3.5)	Cluster
A1	(2, 10)	2	10	2.67	10.7	7	1
A2	(2, 5)	2	5	5.67	5.7	2	3
A3	(8, 4)	8	4	9.33	1.3	7	2
A4	(5, 8)	5	8	2.33	5.7	8	1
A5	(7, 5)	7	5	7.33	0.7	7	2
A6	(6, 4)	6	4	7.33	1.3	5	2
A7	(1, 2)	1	2	9.67	8.3	2	3
A8	(4, 9)	4	9	0.33	7.7	8	1

*Notice that there is no change happened in any cluster, which means that, the centroids calculated in iteration 3 are the final ones and each point now belongs to the right cluster.*