

Ex. Clustering

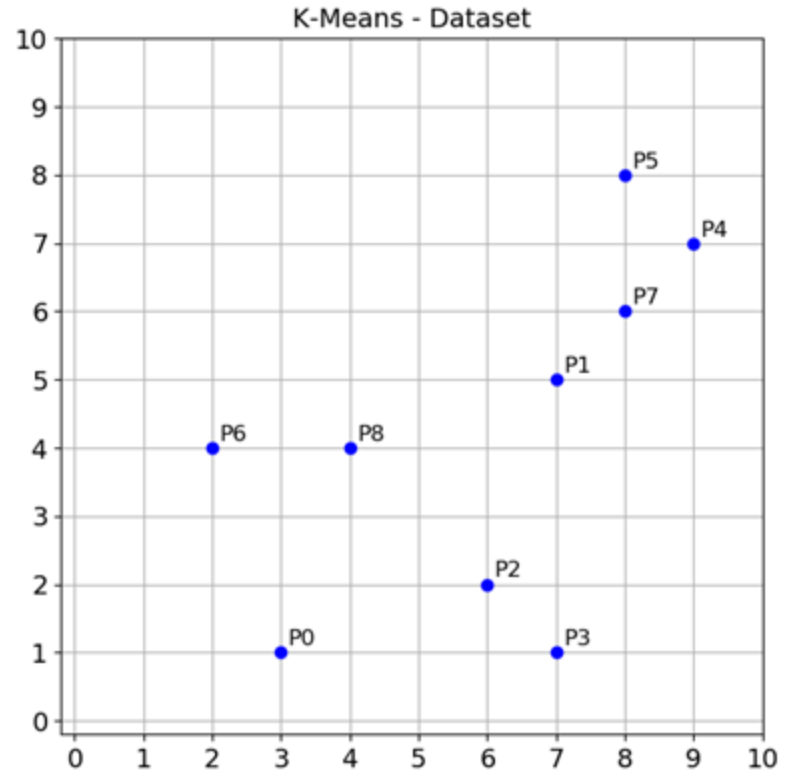
Exercise 1

K-means simulation

Initial centroids:

C1 = P2=(6,2)

C2 = P1=(7,5)



Solution: Identify the Bisecting lines dividing the plane between pairs of centroids

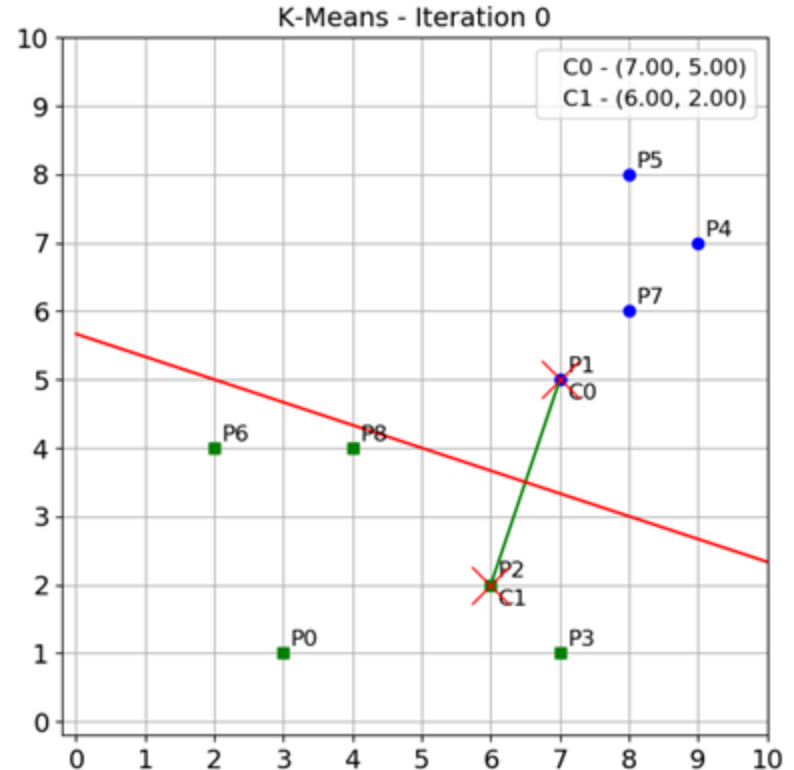
Cluster 1: P0,P2,P3,P6,P8

Cluster 2: P1,P4,P5,P7

Centrod1:

$$X1=(2+3+4+6+7)/5=4.4 \quad Y1=(4+1+4+2+1)/5=2.4$$

$$X2=(6+8+8+9)/4=8 \quad Y2=(5+6+8+7)/4=6.5$$

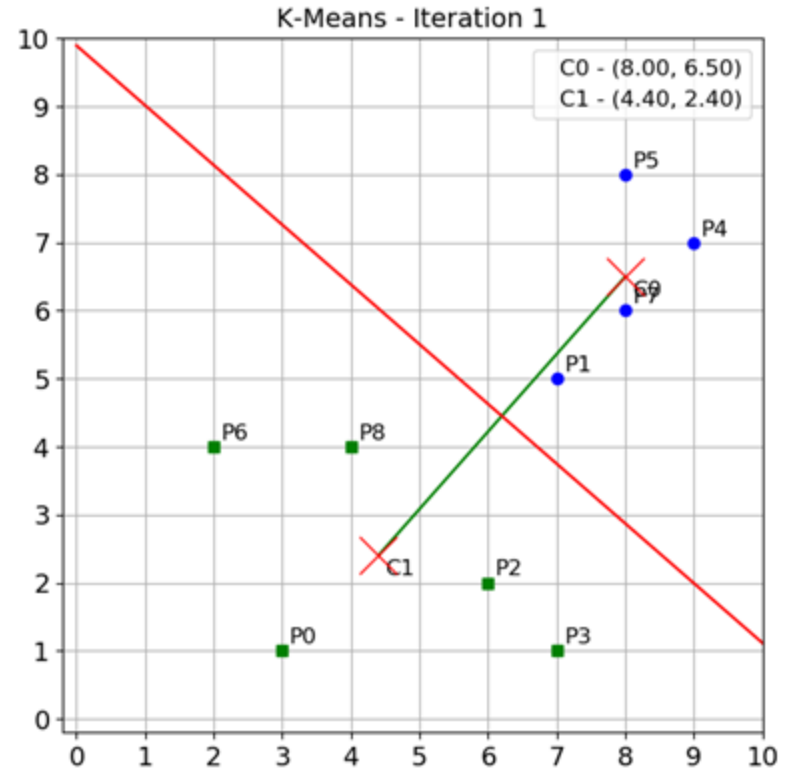


Solution: Identify the Bisecting lines dividing the plane between pairs of centroids

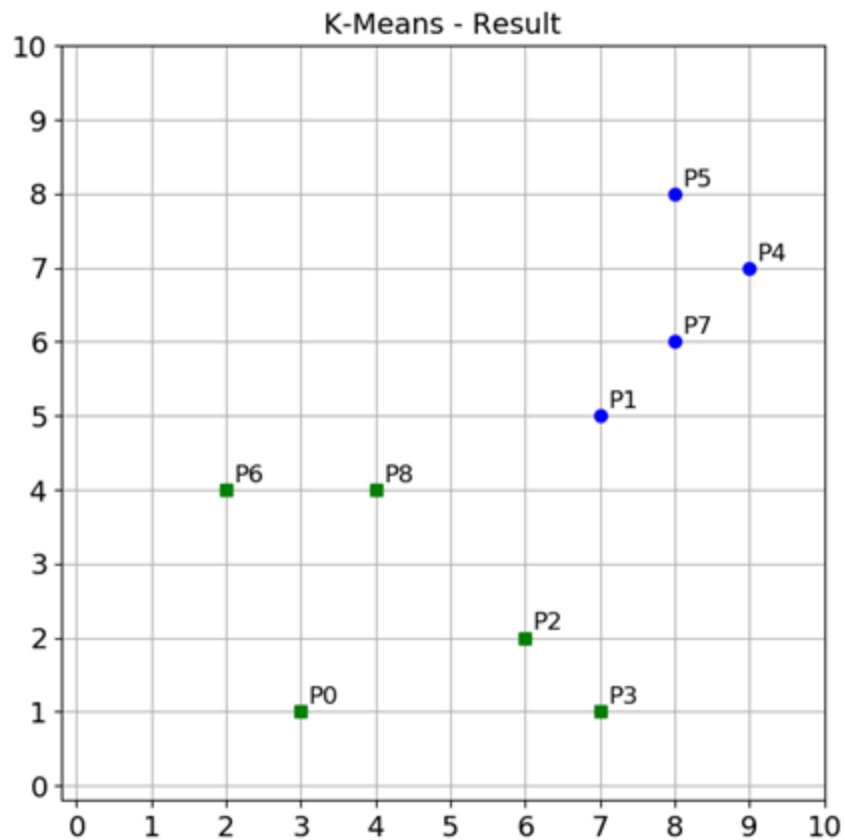
Cluster 1: P0,P2,P3,P6,P8

Cluster 2: P1,P4,P5,P7

The cluster composition does not change,
so K-means stops

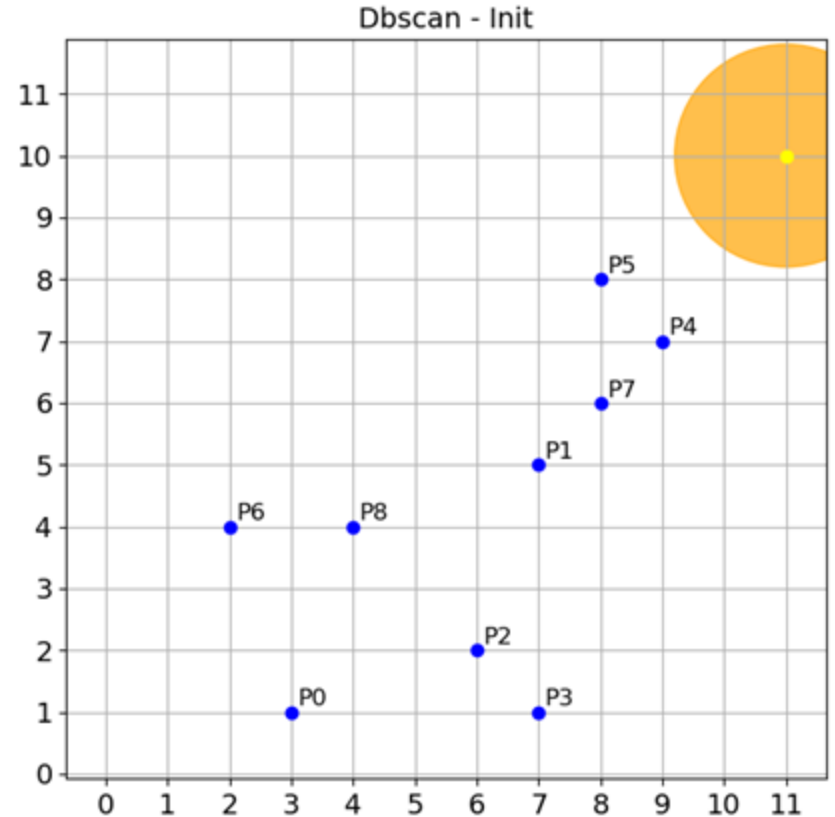


K-means result

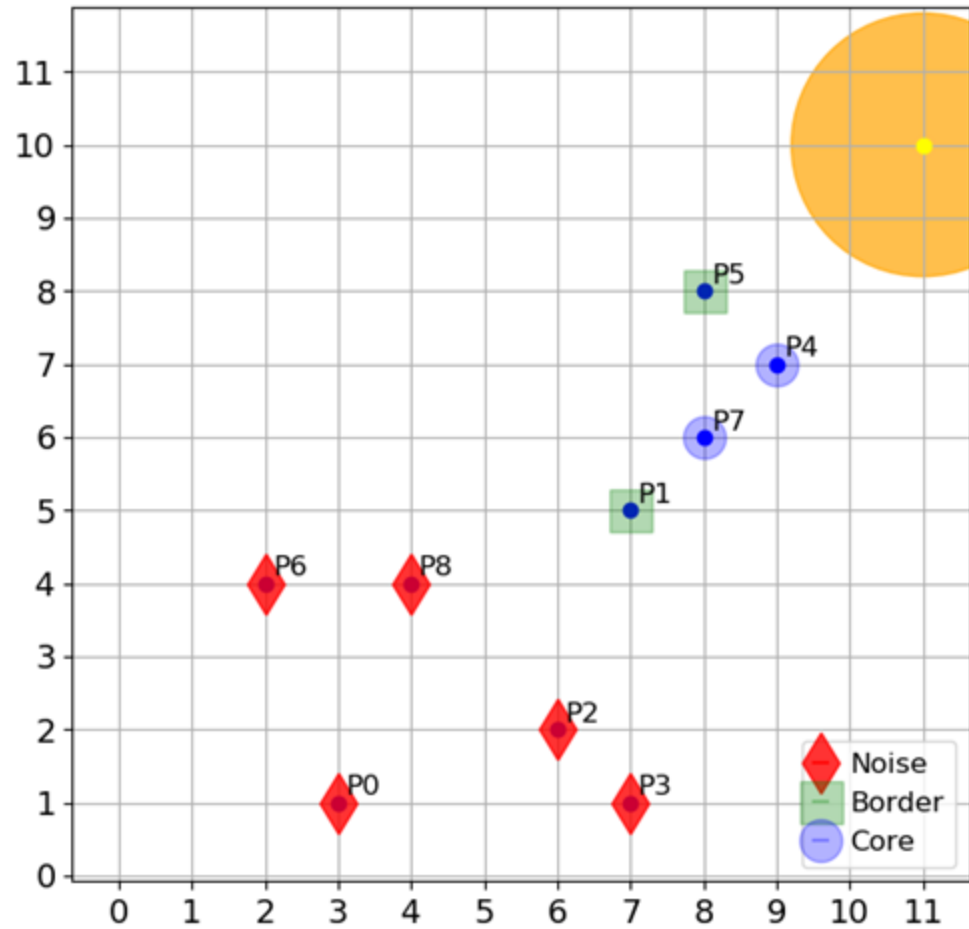


DBSCAN simulation

- Eps=1.8
- MinPoints=3 (included the point)



Dbscan - Noise Points

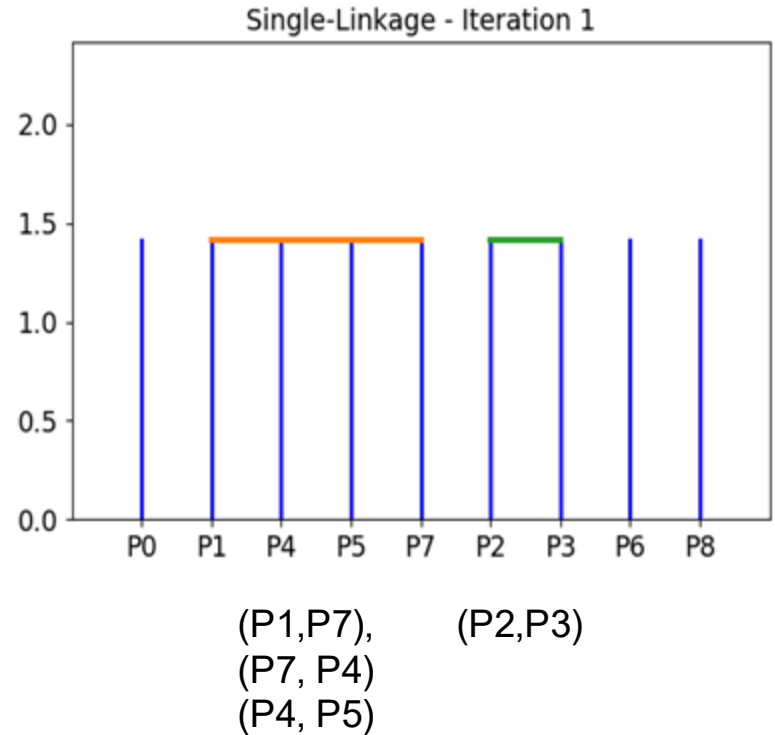


Hierarchical: Single-LINK- Euclidean Distance

	P0	P1	P2	P3	P4	P5	P6	P7	P8
P0	0	5.66	3.16	4	8.49	8.6	3.16	7.07	3.16
P1	5.66	0	3.16	4	2.83	3.16	5.1	1.41	3.16
P2	3.16	3.16	0	1.41	5.83	6.32	4.47	4.47	2.83
P3	4	4	1.41	0	6.32	7.07	5.83	5.1	4.24
P4	8.49	2.83	5.83	6.32	0	1.41	7.62	1.41	5.83
P5	8.6	3.16	6.32	7.07	1.41	0	7.21	2	5.66
P6	3.16	5.1	4.47	5.83	7.62	7.21	0	6.32	2
P7	7.07	1.41	4.47	5.1	1.41	2	6.32	0	4.47
P8	3.16	3.16	2.83	4.24	5.83	5.66	2	4.47	0

distance merge 1.41

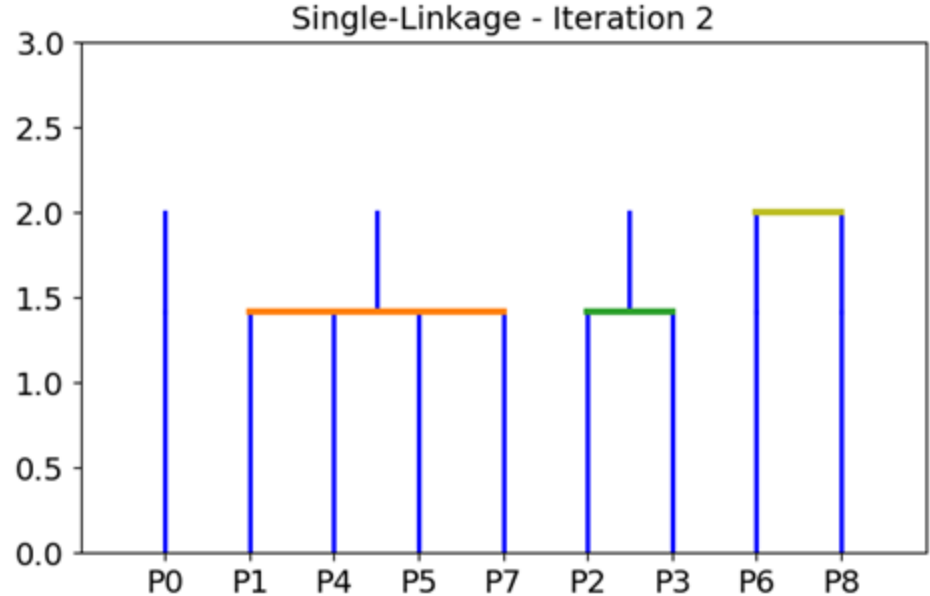
Min Distance



Hierarchical: **Single-LINK**- Euclidean Distance

	[(0,),	(1,4,5,7)	(2, 3),	(6,),	(8,)]
0	[0.	5.66	3.16	3.16	3.16]
(1,4,5,7)	[5.66	0.	3.16	5.1	3.16]
(2,3)	[3.16	3.16	0.	4.47	2.83]
6	[3.16	5.1	4.47	0.	2.]
8	[3.16	3.16	2.83	2.	0.]

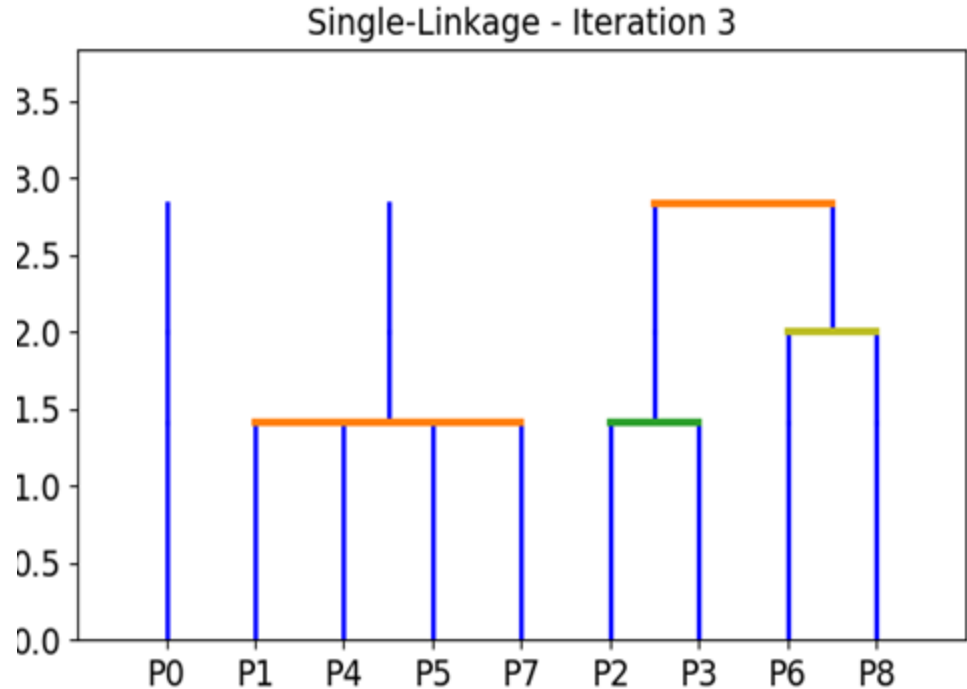
distance merge 2.00



Hierarchical: Single-LINK- Euclidean Distance

	[(0,),	(1,4,5,7)	(2, 3),	(6, 8)]
0	[0.	5.66	3.16	3.16]
(1,4,5,7)	[5.66	0.	3.16	3.16]
(2,3)	[3.16	3.16	0.	2.83]
(6,8)	[3.16	3.16	2.83	0.]

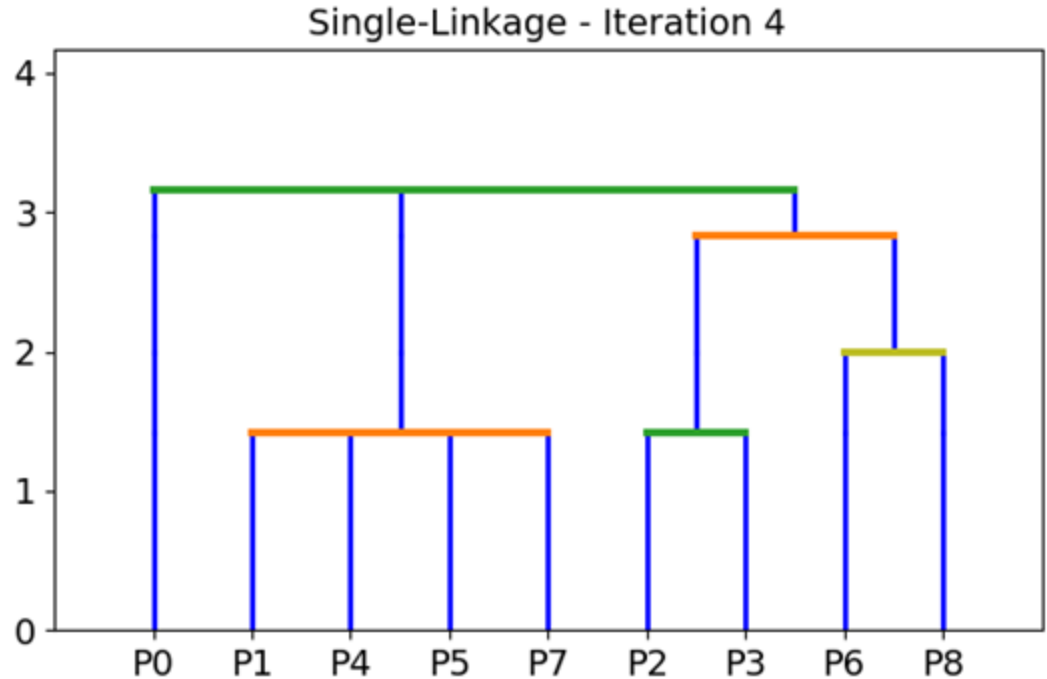
distance merge 2.83



Hierarchical: Single-LINK- Euclidean Distance

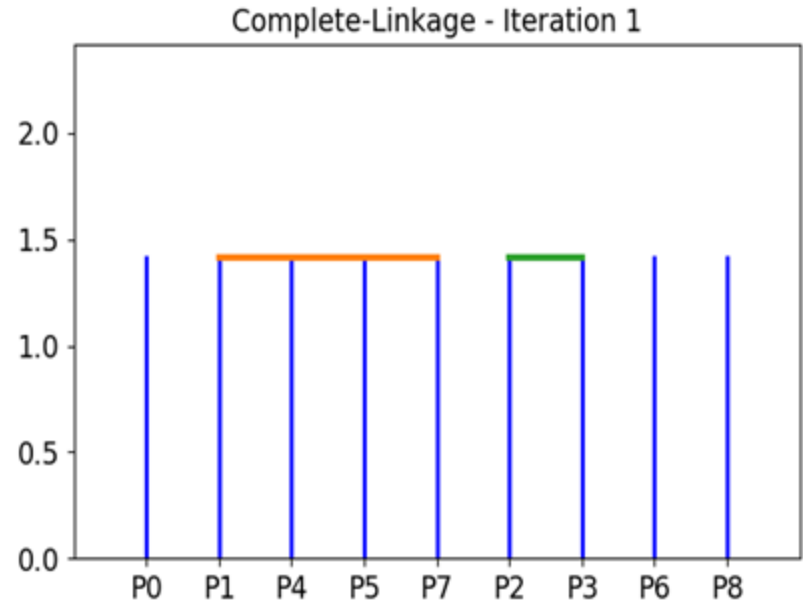
	[(0,), (1,4,5,7) (2,3,6,8)]	
0	[0. 5.66 3.16]	
(1,4,5,7)	[5.66 0. 3.16]	
(2,3, 6,8)	[3.16 3.16 0.]	

distance merge 3.16



Hierarchical: **Complete-LINK**- Euclidean Distance

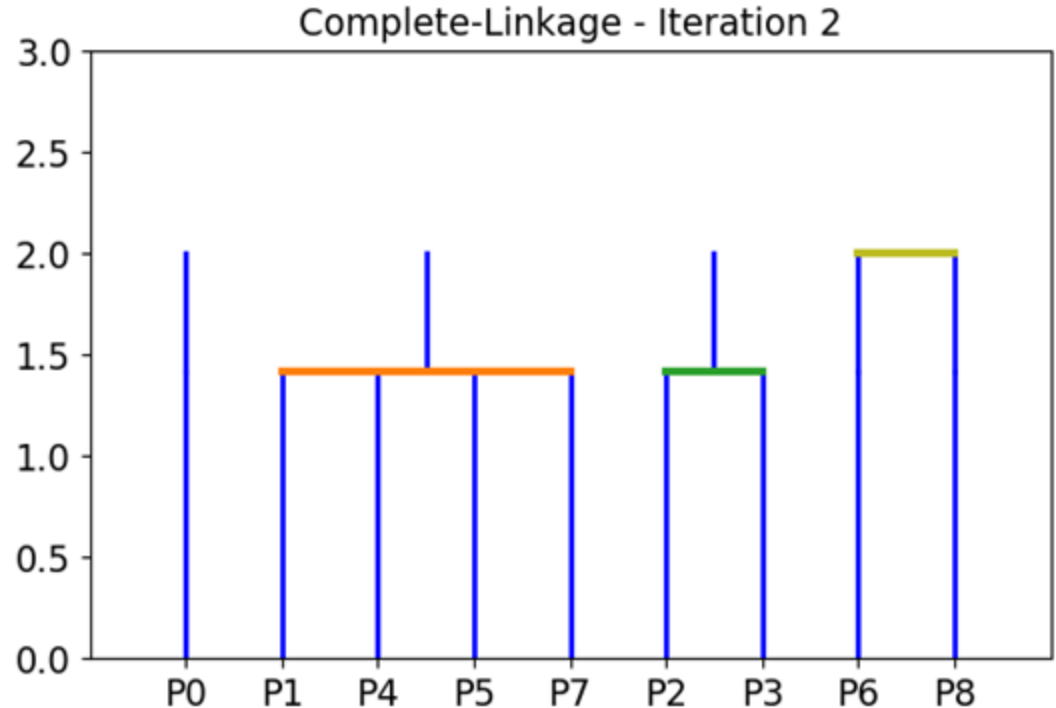
	P0	P1	P2	P3	P4	P5	P6	P7	P8
P0	0	5.66	3.16	4	8.49	8.6	3.16	7.07	3.16
P1	5.66	0	3.16	4	2.83	3.16	5.1	1.41	3.16
P2	3.16	3.16	0	1.41	5.83	6.32	4.47	4.47	2.83
P3	4	4	1.41	0	6.32	7.07	5.83	5.1	4.24
P4	8.49	2.83	5.83	6.32	0	1.41	7.62	1.41	5.83
P5	8.6	3.16	6.32	7.07	1.41	0	7.21	2	5.66
P6	3.16	5.1	4.47	5.83	7.62	7.21	0	6.32	2
P7	7.07	1.41	4.47	5.1	1.41	2	6.32	0	4.47
P8	3.16	3.16	2.83	4.24	5.83	5.66	2	4.47	0



Hierarchical: Complete-LINK- Euclidean Distance

	[(0)	(1,4,5,7)	(2, 3)	(6)	(8)]
0	[0.	8.6	4.	3.16	3.16]
(1,4,5,7)	[8.6	0.	7.07	7.62	5.83]
(2,3)	[4.	7.07	0.	5.83	4.24]
6	[3.16	7.62	5.83	0.	2.]
8	[3.16	5.83	4.24	2.	0.]

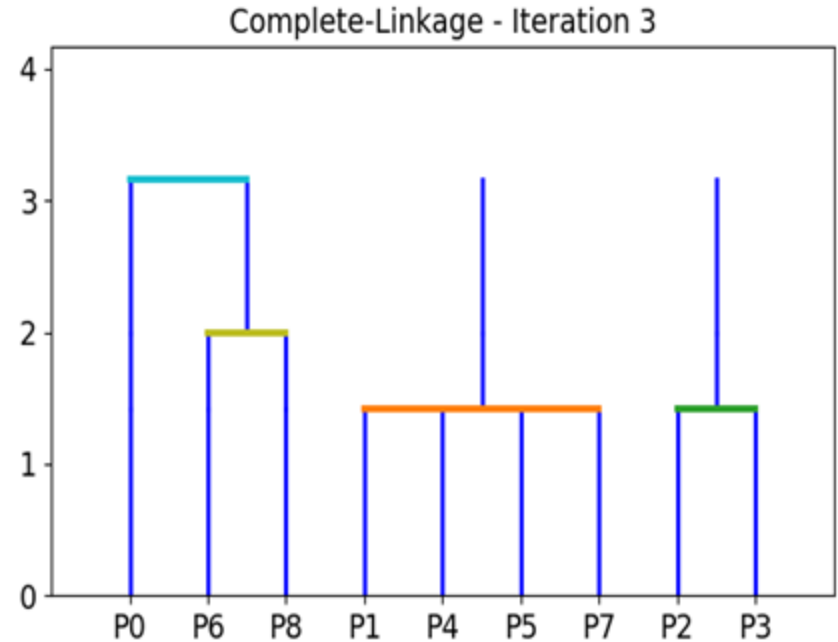
distance merge 2.00



Hierarchical: Complete-LINK- Euclidean Distance

	[(0)	(1,4,5,7)	(2, 3)	(6,8)
0	[0.	8.6	4.	3.16]
(1,4,5,7)	[8.6	0.	7.07	7.62]
(2,3)	[4.	7.07	0.	5.83]
(6,8)	[3.16	7.62	5.83	0.]

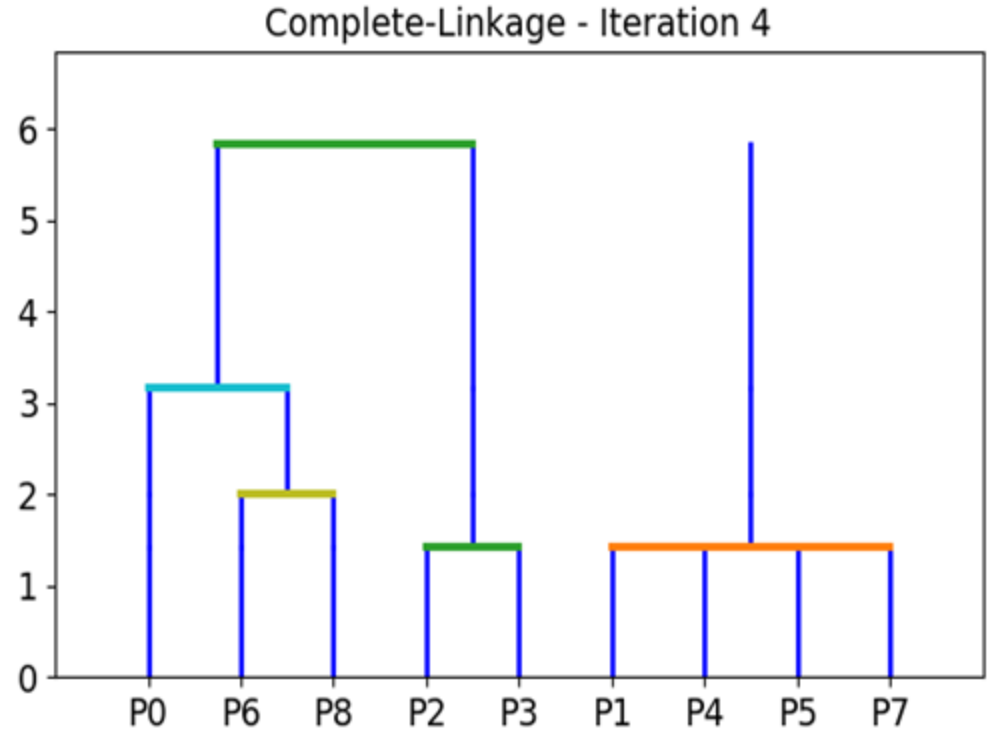
distance merge 3.16



Hierarchical: Complete-LINK- Euclidean Distance

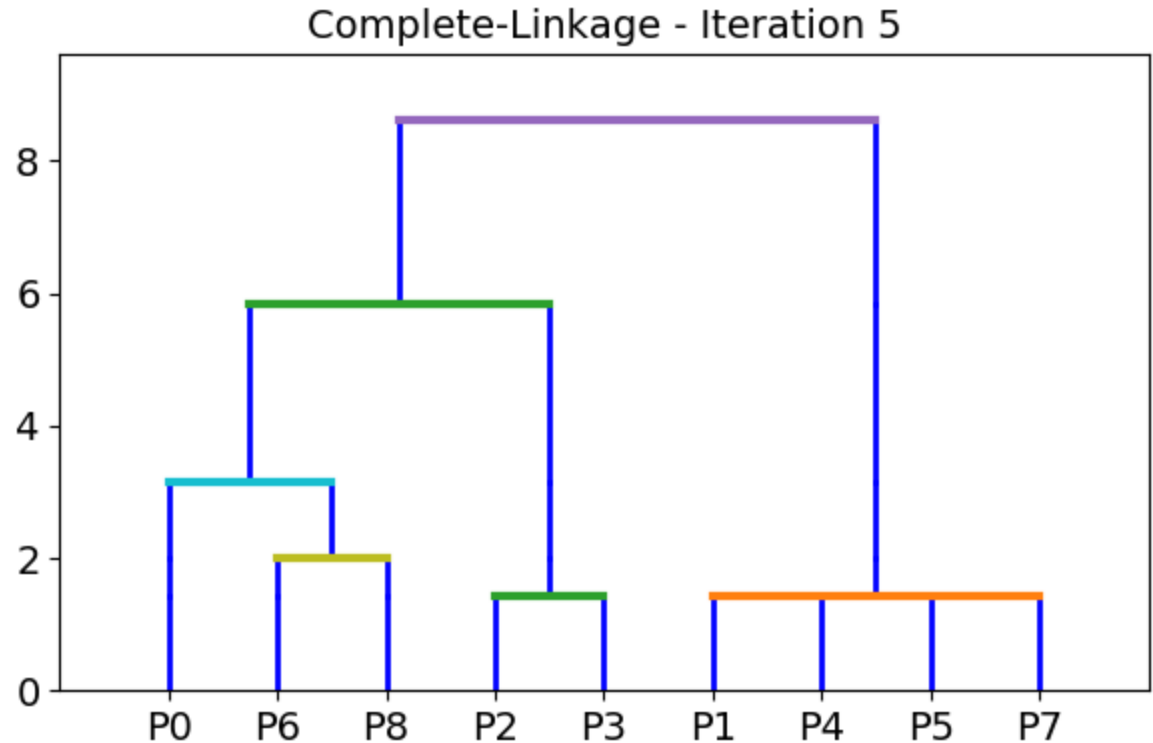
	[(0,6,8)]	(1,4,5,7)	(2, 3)]
(0,6,8)	[0.	8.6	5.83]
(1,4,5,7)	[8.6	0.	7.07]
(2,3)	[5.83	7.07	0.]

distance merge 5.83



Hierarchical: Complete-LINK- Euclidean Distance

[(0,2,3,6,8)	(1,4,5,7)
[0.	8.6]
[8.6	0.]



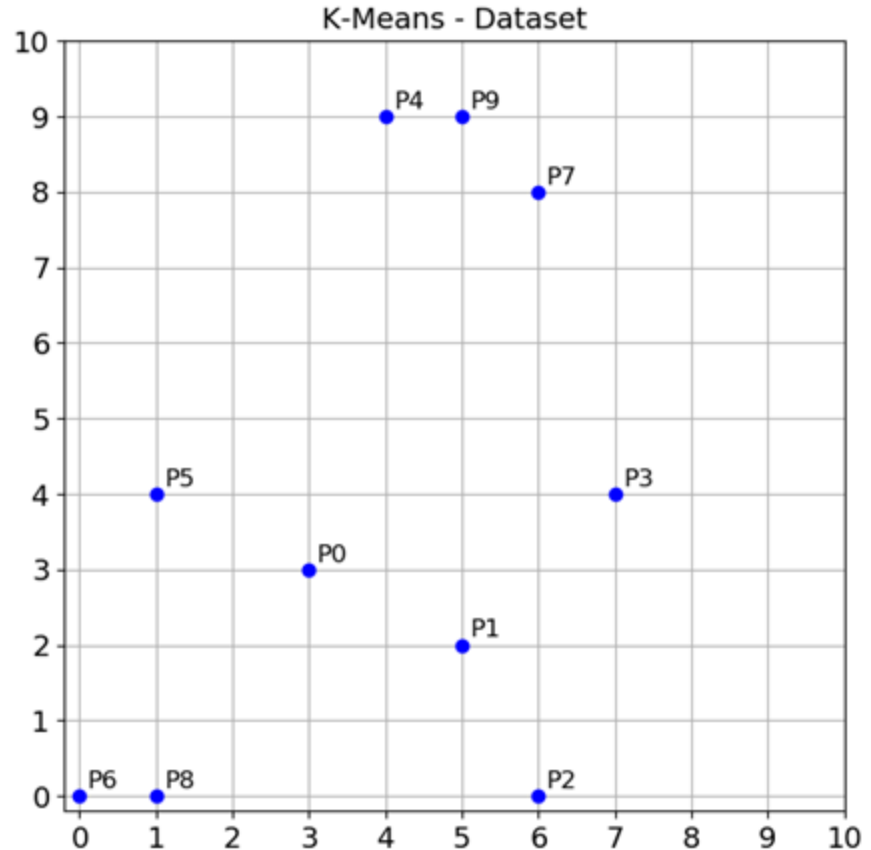
Exercise 2

K-means simulation

Initial centroids:

C1 = P1=(5,2)

C2 = P5=(1,4)



Solution: Identify the Bisecting lines dividing the plane between pairs of centroids

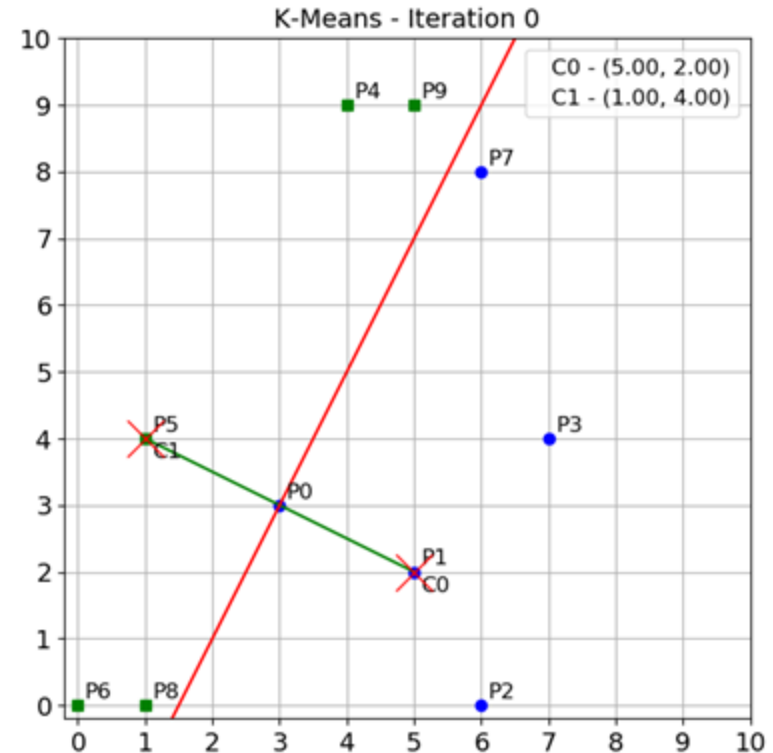
Cluster 1: P0,P1,P2,P3,P7

Cluster 2: P5,P4,P6,P8,P9

Centrod1:

C1= (5.40, 3.40)

C2= (2.20, 4.40)



Solution: Identify the Bisecting lines dividing the plane between pairs of centroids

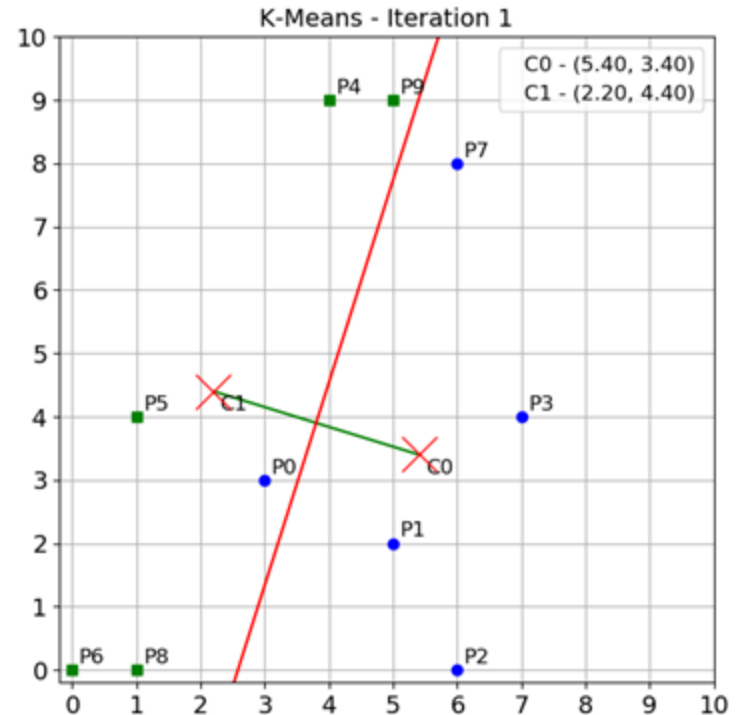
Cluster 1: P1,P2,P3,P7

Cluster 2: P5,P4,P6,P8,P9,P0

Centrod1:

C1= (6.00, 3.50)

C2= (2.33, 4.17)

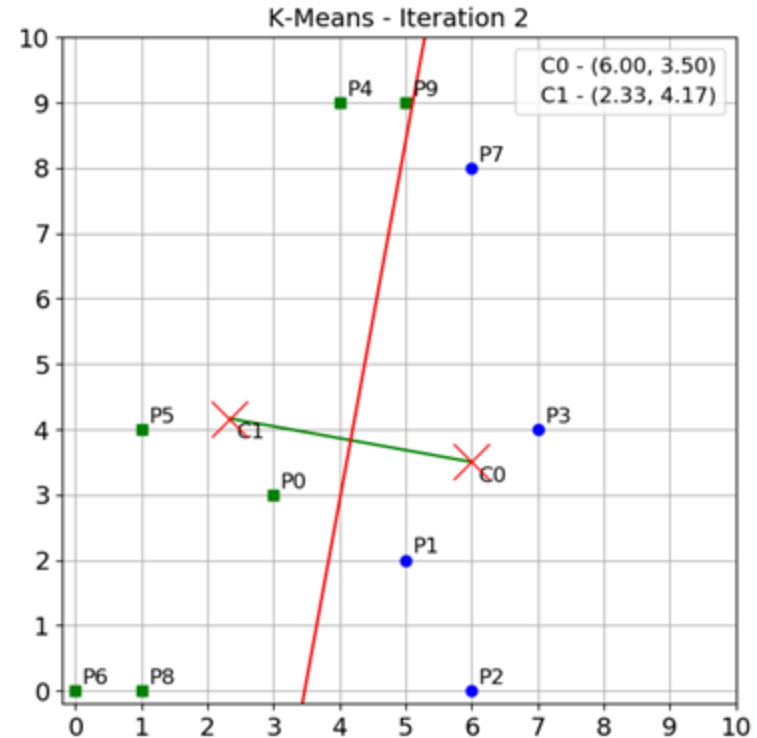


Solution: Identify the Bisecting lines dividing the plane between pairs of centroids

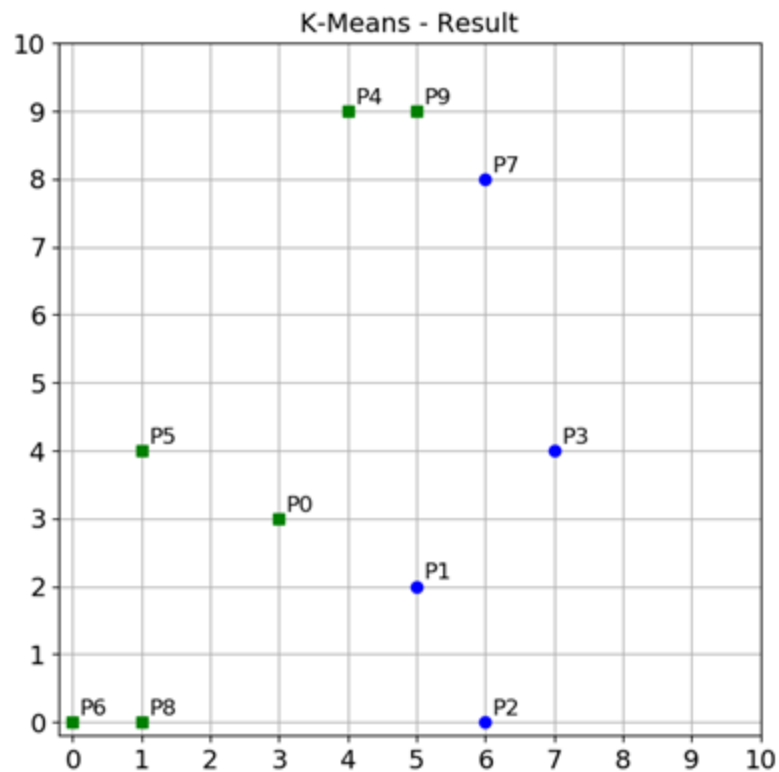
Cluster 1: P1,P2,P3,P7

Cluster 2: P5,P4,P6,P8,P9,P0

The cluster composition does not change,
so K-means stops

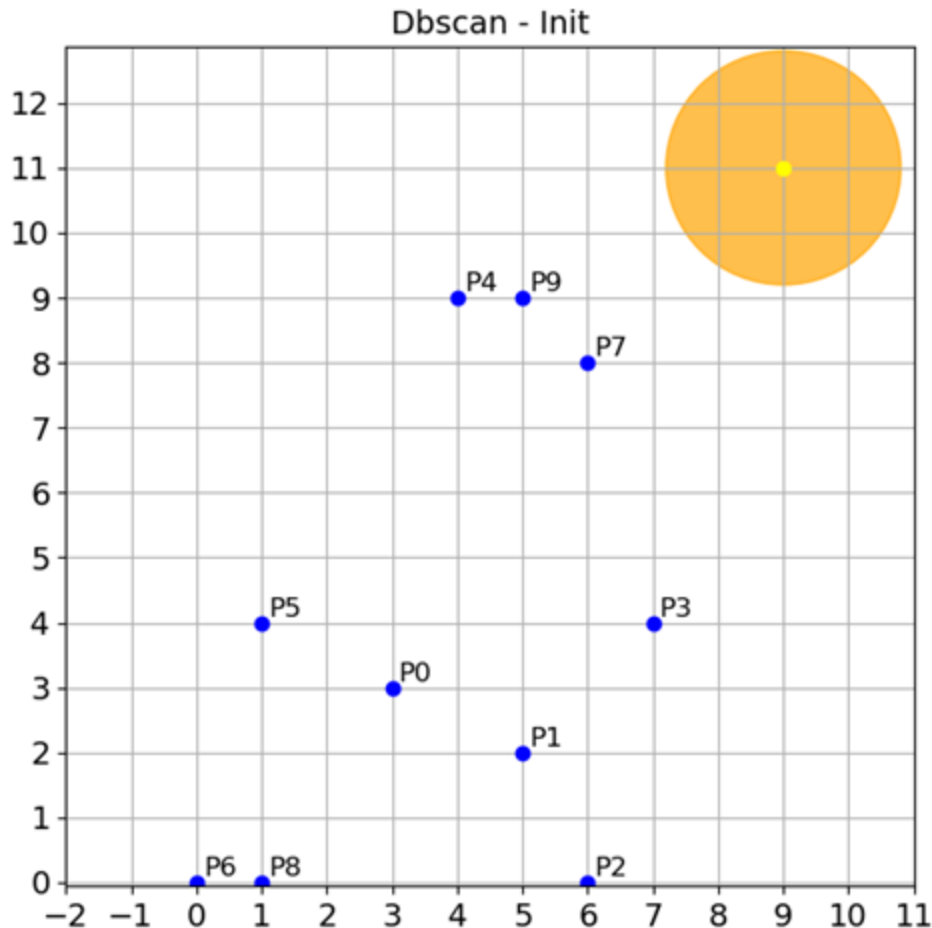


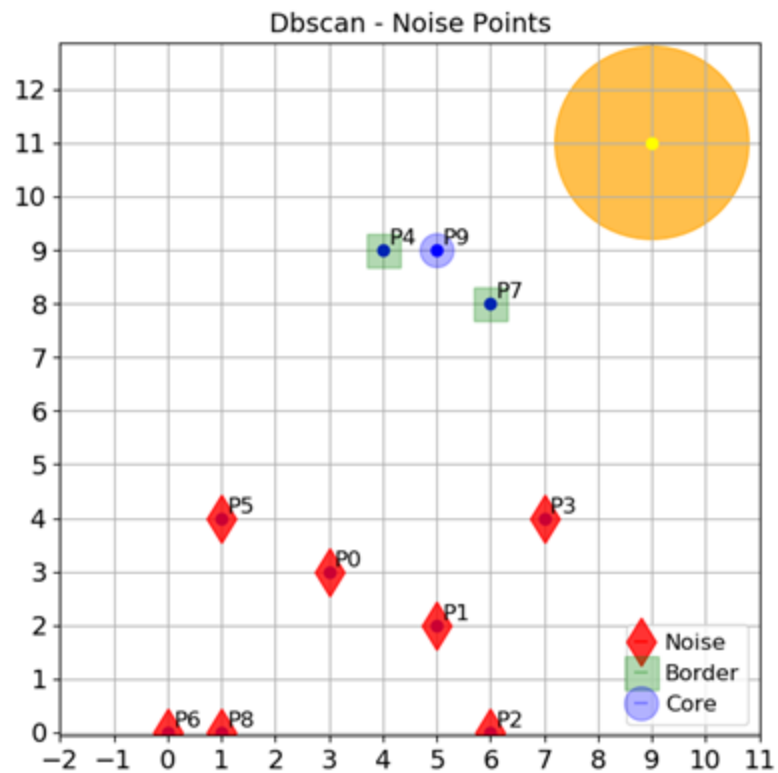
K-means result



DBSCAN simulation

- Eps=1.8
- MinPoints=3 (included the point)

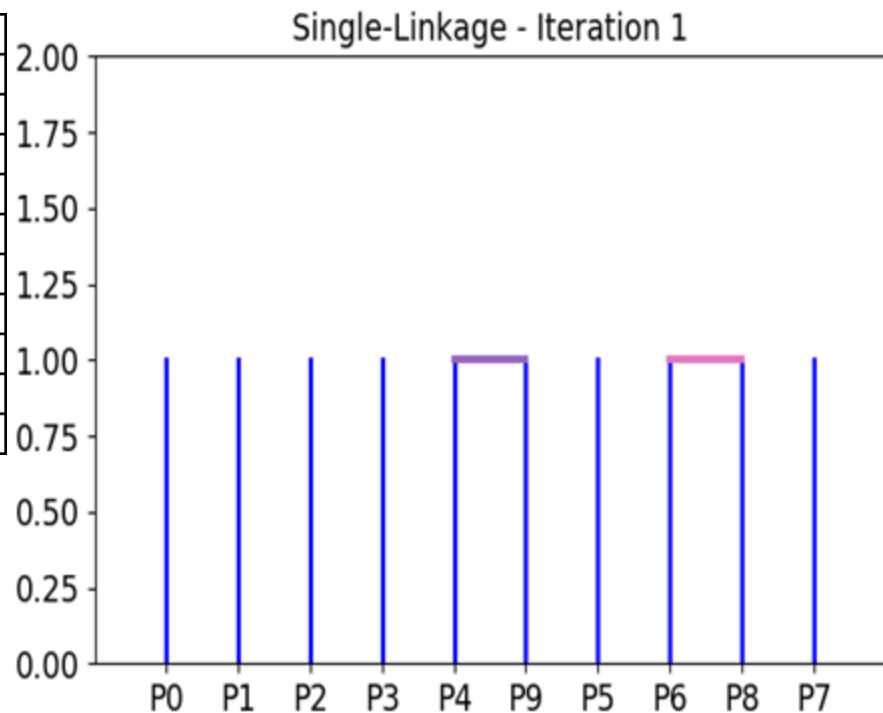




Hierarchical: Single-LINK- Euclidean Distance

(0)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
0.	2.24	4.24	4.12	6.08	2.24	4.24	5.83	3.61	6.32
2.24	0.	2.24	2.83	7.07	4.47	5.39	6.08	4.47	7.
4.24	2.24	0.	4.12	9.22	6.4	6.	8.	5.	9.06
4.12	2.83	4.12	0.	5.83	6.	8.06	4.12	7.21	5.39
6.08	7.07	9.22	5.83	0.	5.83	9.85	2.24	9.49	1.
2.24	4.47	6.4	6.	5.83	0.	4.12	6.4	4.	6.4
4.24	5.39	6.	8.06	9.85	4.12	0.	10.	1.	10.3
5.83	6.08	8.	4.12	2.24	6.4	10.	0.	9.43	1.41
3.61	4.47	5.	7.21	9.49	4.	1.	9.43	0.	9.85
6.32	7.	9.06	5.39	1.	6.4	10.3	1.41	9.85	0.

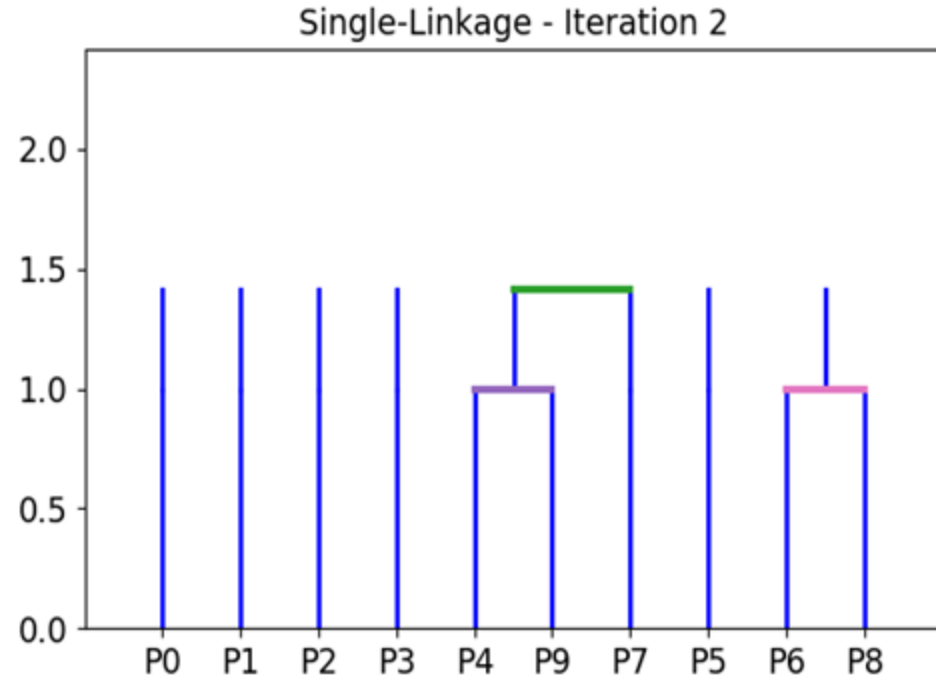
distance merge 1.00



Hierarchical: Single-LINK- Euclidean Distance

(0)	(1)	(2)	(3)	(4,9)	(5)	(6,8)	(7)
[0.	2.24	4.24	4.12	6.08	2.24	3.61	5.83]
[2.24	0.	2.24	2.83	7.	4.47	4.47	6.08]
[4.24	2.24	0.	4.12	9.06	6.4	5.	8.]
[4.12	2.83	4.12	0.	5.39	6.	7.21	4.12]
[6.08	7.	9.06	5.39	0.	5.83	9.49	1.41]
[2.24	4.47	6.4	6.	5.83	0.	4.	6.4]
[3.61	4.47	5.	7.21	9.49	4.	0.	9.43]
[5.83	6.08	8.	4.12	1.41	6.4	9.43	0.]

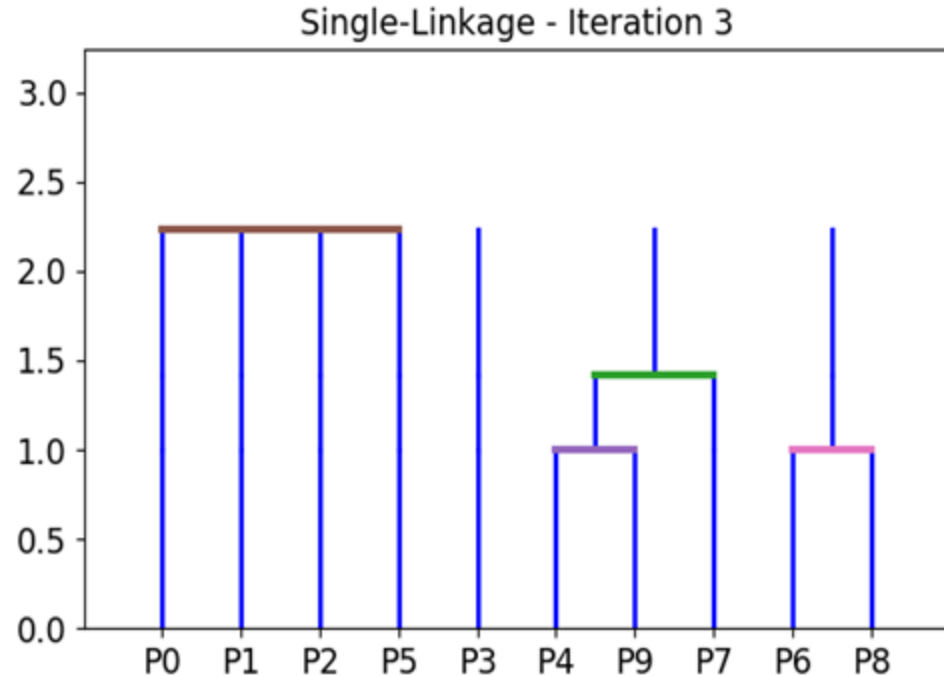
distance merge 1.41



Hierarchical: Single-LINK- Euclidean Distance

(0)	(1)	(2)	(3)	(4,7,9)	(5)	(6,8)
[0.	2.24	4.24	4.12	5.83	2.24	3.61]
[2.24	0.	2.24	2.83	6.08	4.47	4.47]
[4.24	2.24	0.	4.12	8.	6.4	5.]
[4.12	2.83	4.12	0.	4.12	6.	7.21]
[5.83	6.08	8.	4.12	0.	5.83	9.43]
[2.24	4.47	6.4	6.	5.83	0.	4.]
[3.61	4.47	5.	7.21	9.43	4.	0.]

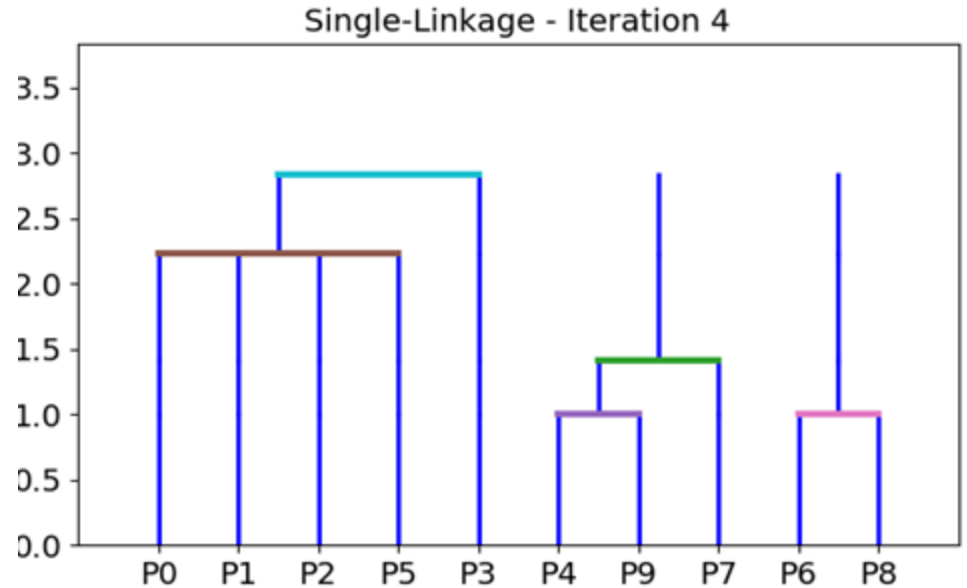
distance merge 2.24



Hierarchical: Single-LINK- Euclidean Distance

(0,1,2,5)	(3)	(4,7,9)	(6,8)
[[0.	2.83	5.83	3.61]
[2.83	0.	4.12	7.21]
[5.83	4.12	0.	9.43]
[3.61	7.21	9.43	0.]

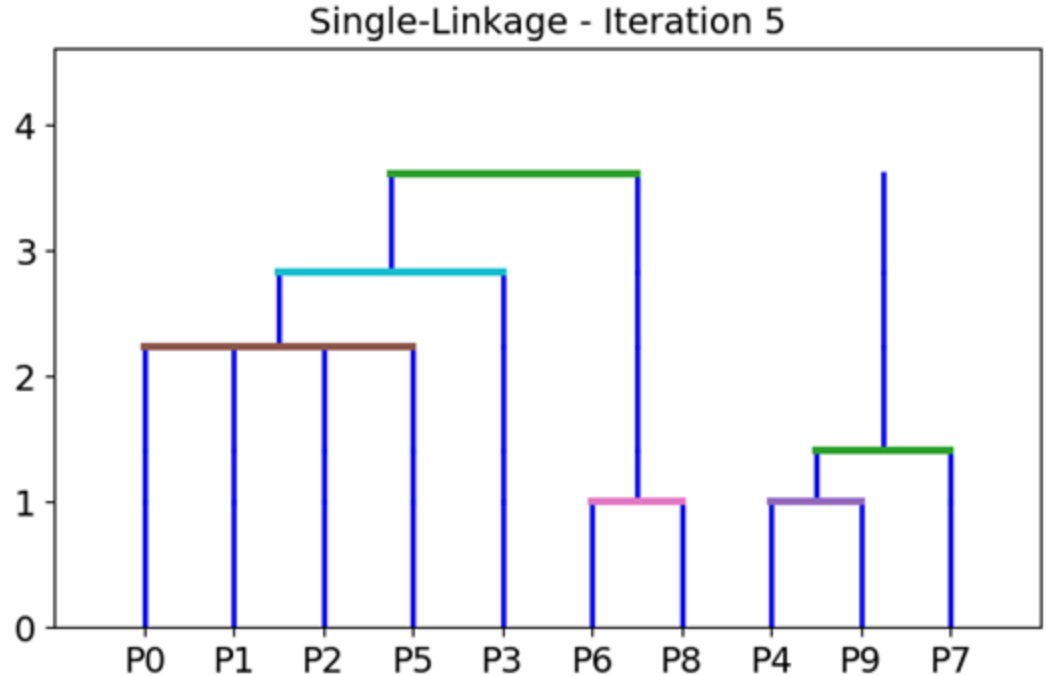
distance merge 2.83



Hierarchical: Single-LINK- Euclidean Distance

(0,1,2,3,5)	(4,7,9)	(6,8)
[0.	4.12	3.61]
[4.12	0.	9.43]
[3.61	9.43	0.]

distance merge 3.61



Hierarchical: Single-LINK- Euclidean Distance

(0,1,2,3,5,6,8	(4,7,9)
[0.	4.12]
[4.12	0.]

