

Ex. Clustering

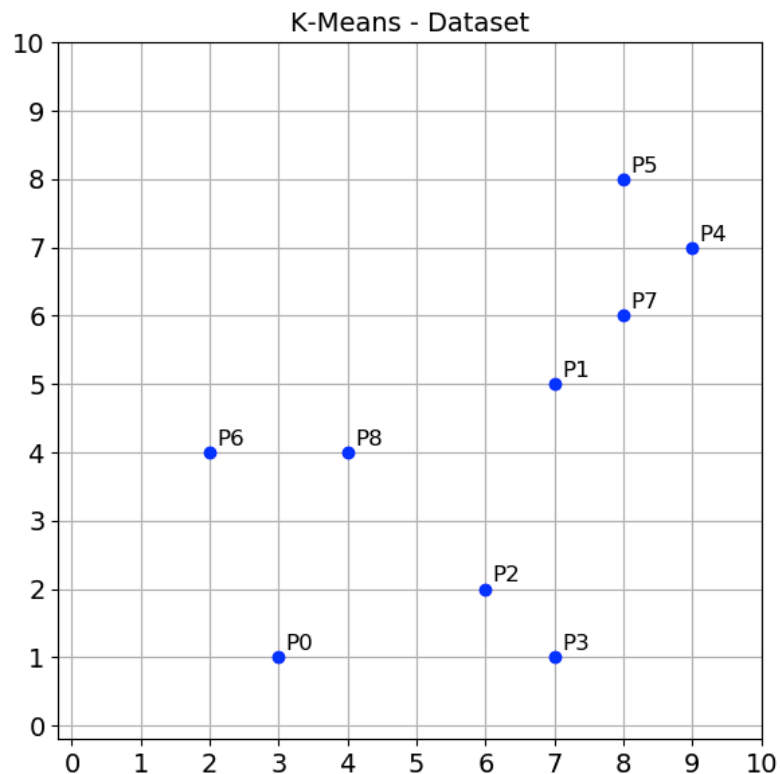
Exercise 1

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

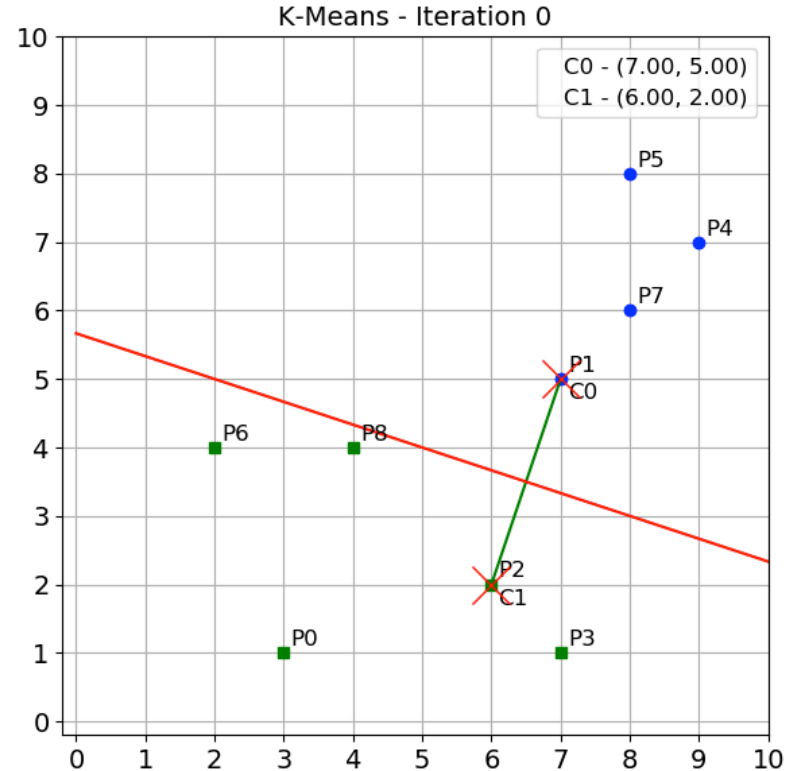
Cluster 1: P0,P2,P3,P6,P8

Cluster 2: P1,P4,P5,P7

Centroid1:

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

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

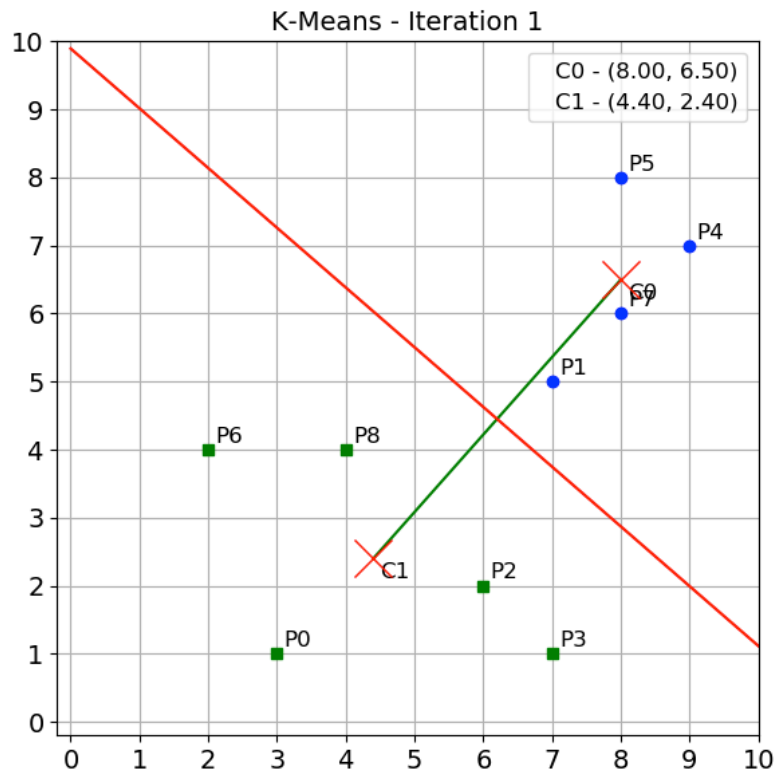


Solution: Identify the Bisecting lines dividing the plane between pairs of centroids

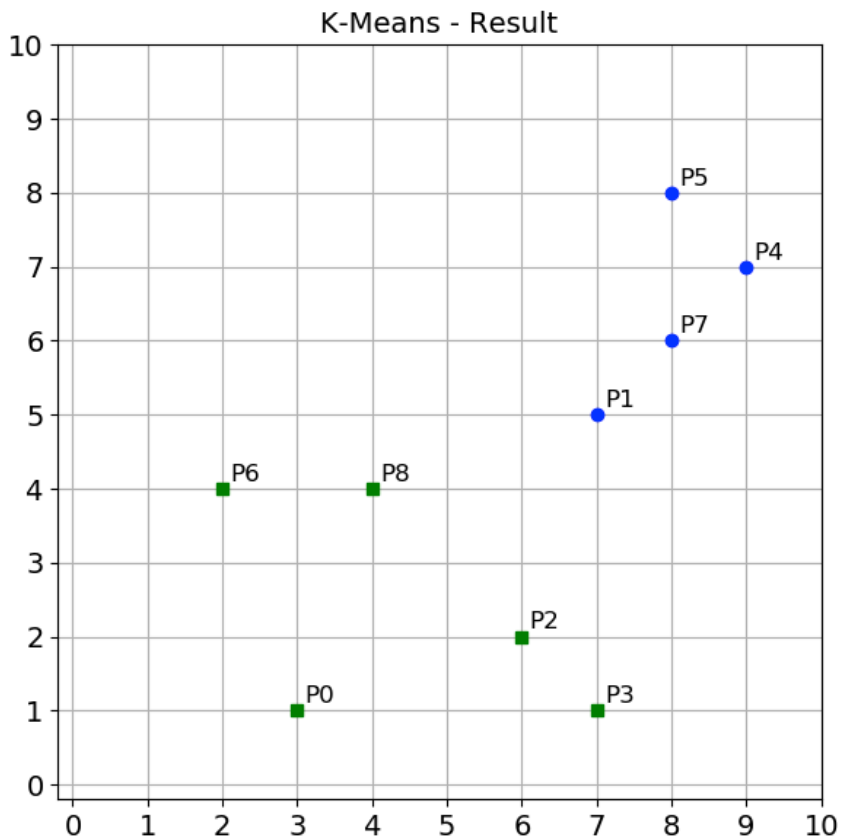
Cluster 1: P0,P2,P3,P6,P8

Cluster 2: P1,P4,P5,P7

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

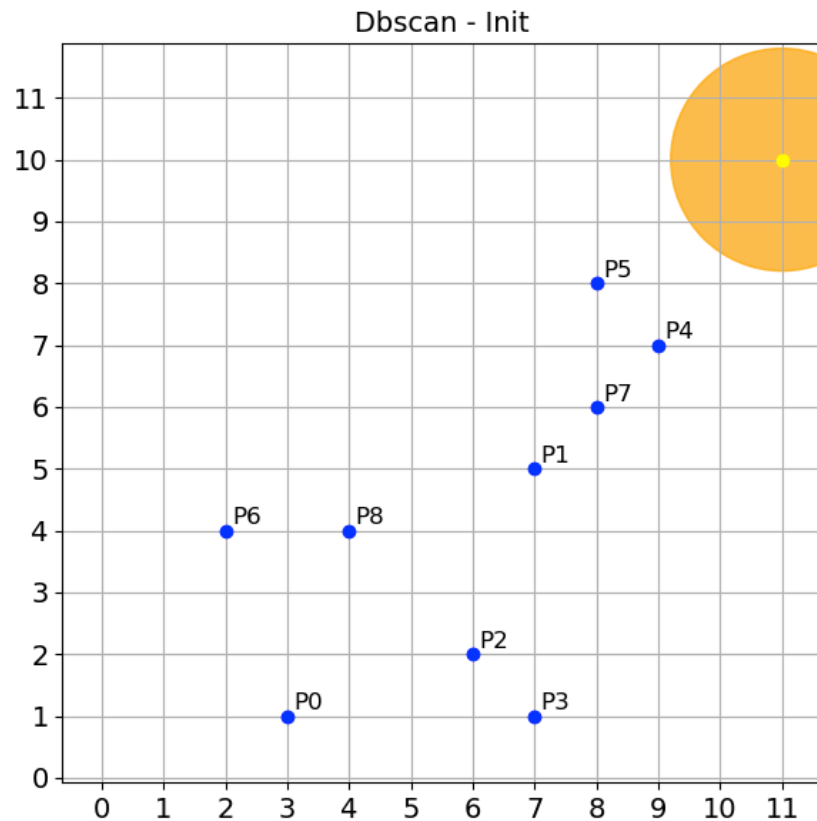


K-means result

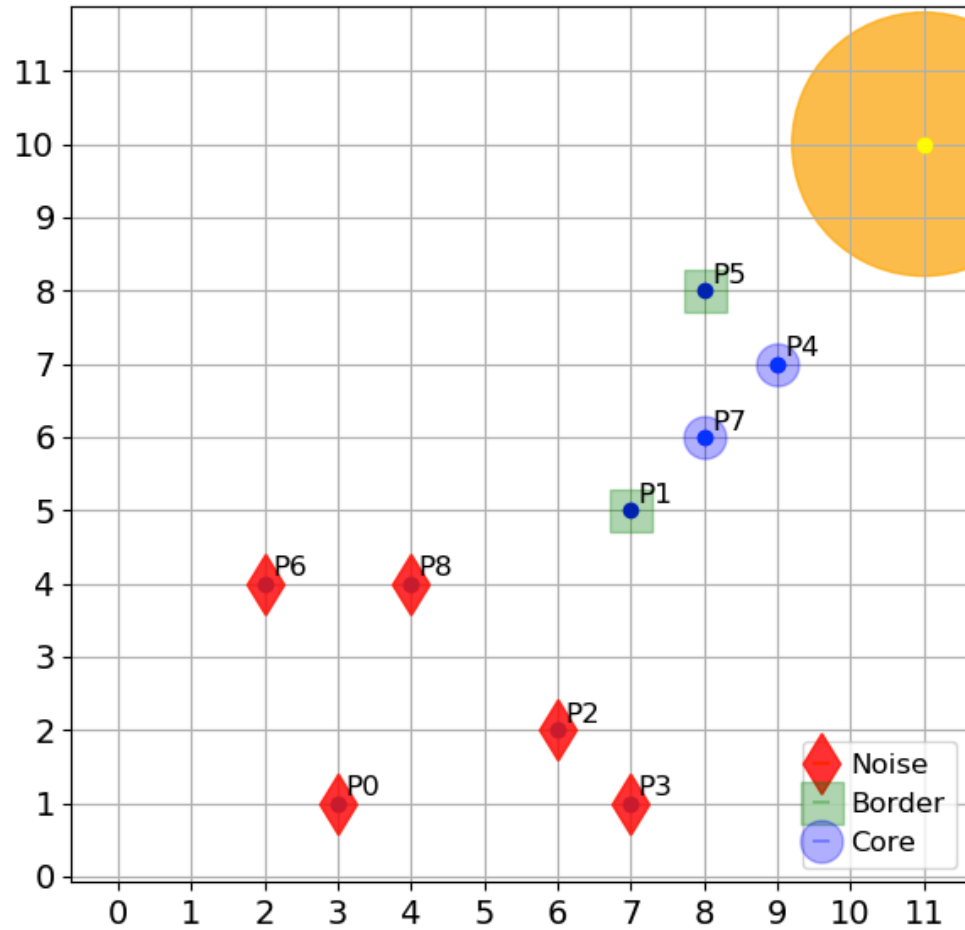


DBSCAN simulation

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



Dbscan - Noise Points



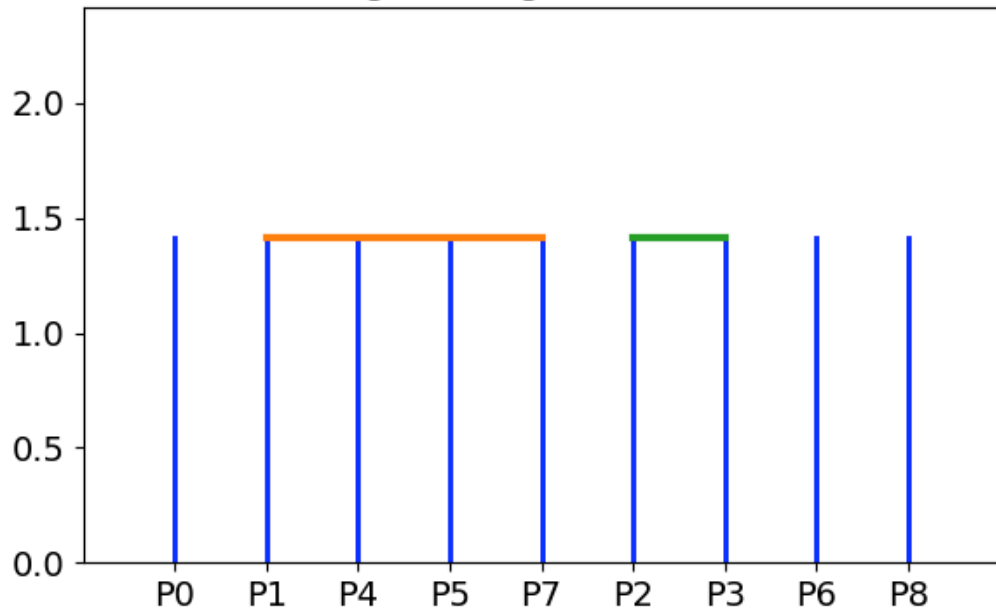
Hierarchical: Single-LINK- Euclidean Distance

0	5.66	3.16	4	8.49	8.6	3.16	7.07	3.16
5.66	0	3.16	4	2.83	3.16	5.1	1.41	3.16
3.16	3.16	0	1.41	5.83	6.32	4.47	4.47	2.83
4	4	1.41	0	6.32	7.07	5.83	5.1	4.24
8.49	2.83	5.83	6.32	0	1.41	7.62	1.41	5.83
8.6	3.16	6.32	7.07	1.41	0	7.21	2	5.66
3.16	5.1	4.47	5.83	7.62	7.21	0	6.32	2
7.07	1.41	4.47	5.1	1.41	2	6.32	0	4.47
3.16	3.16	2.83	4.24	5.83	5.66	2	4.47	0

distance merge 1.41

Min
Distance

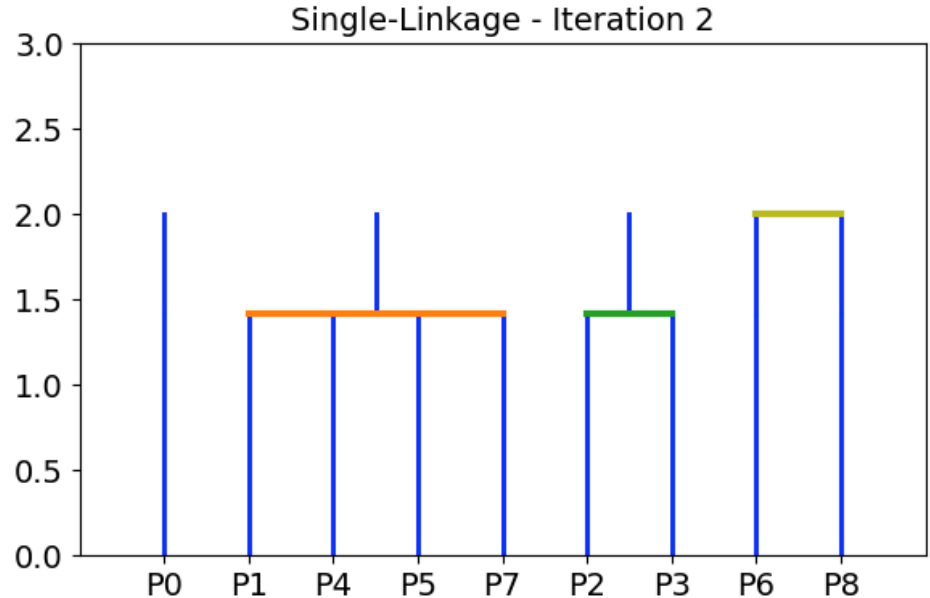
Single-Linkage - Iteration 1



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

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

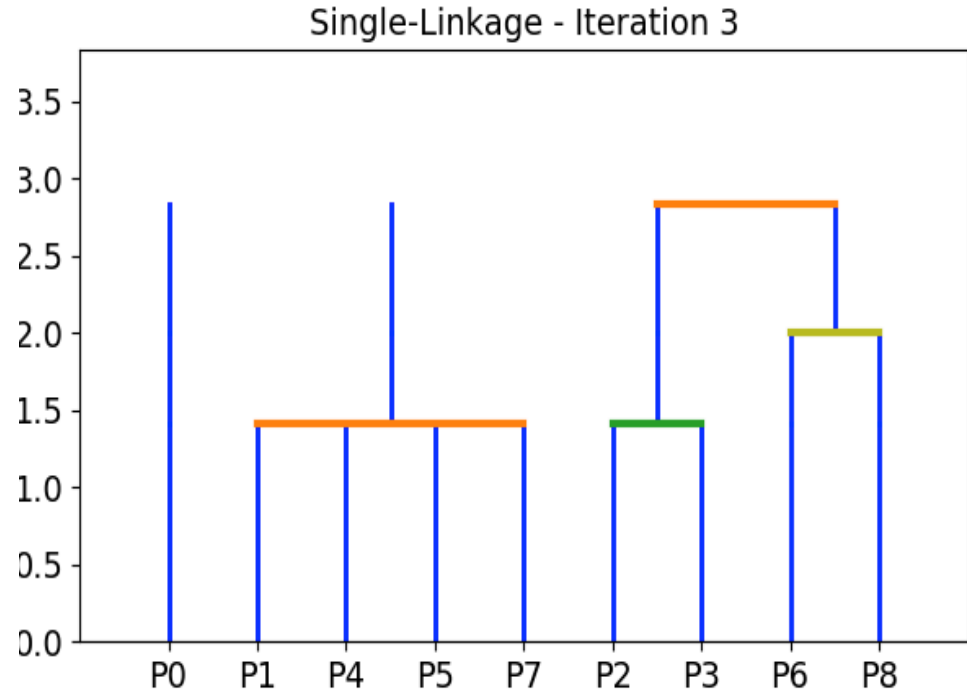
distance merge 2.00



Hierarchical: Single-LINK- Euclidean Distance

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

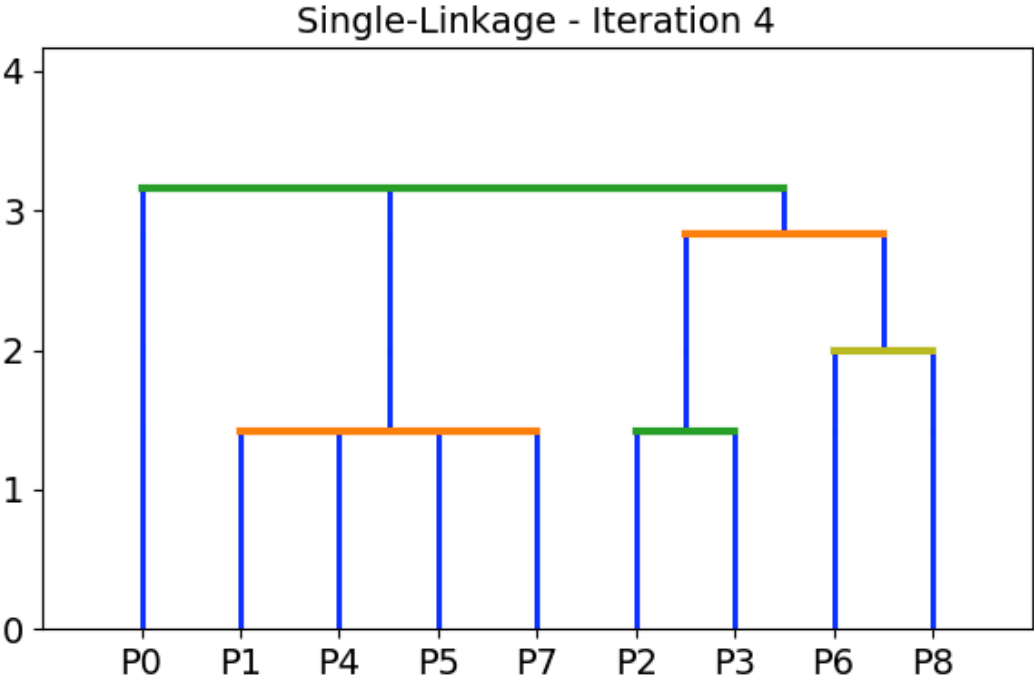
distance merge 2.83



Hierarchical: Single-LINK- Euclidean Distance

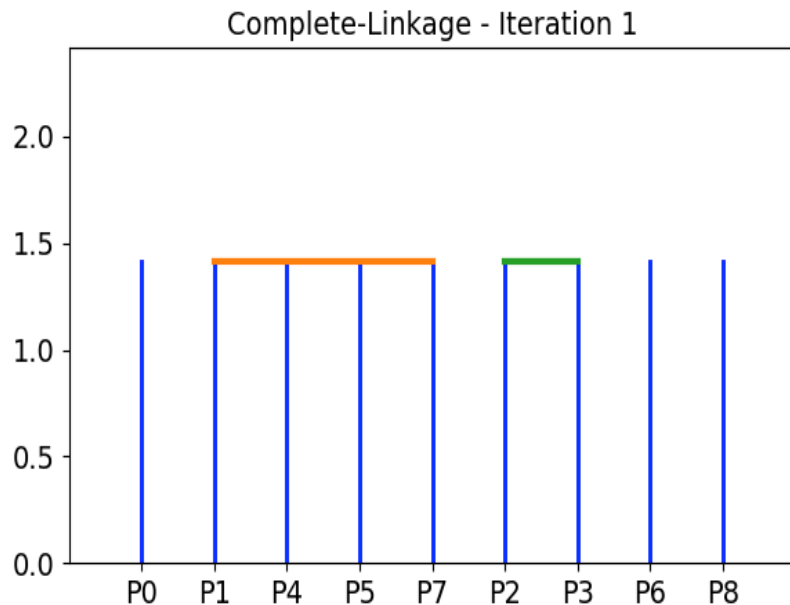
[(0,), (1,4,5,7) (2,3,6,8)]
[0. 5.66 3.16]
[5.66 0. 3.16]
[3.16 3.16 0.]

distance merge 3.16



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

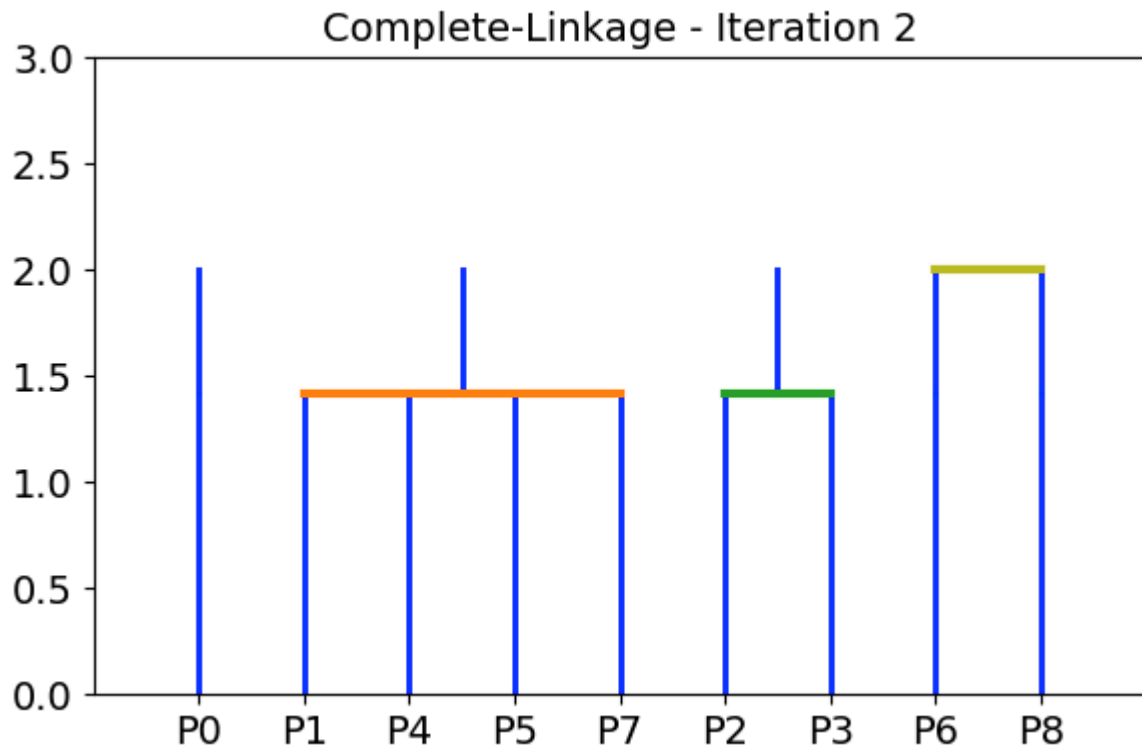
0	5.66	3.16	4	8.49	8.6	3.16	7.07	3.16
5.66	0	3.16	4	2.83	3.16	5.1	1.41	3.16
3.16	3.16	0	1.41	5.83	6.32	4.47	4.47	2.83
4	4	1.41	0	6.32	7.07	5.83	5.1	4.24
8.49	2.83	5.83	6.32	0	1.41	7.62	1.41	5.83
8.6	3.16	6.32	7.07	1.41	0	7.21	2	5.66
3.16	5.1	4.47	5.83	7.62	7.21	0	6.32	2
7.07	1.41	4.47	5.1	1.41	2	6.32	0	4.47
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.	8.6	4.	3.16	3.16]
[8.6	0.	7.07	7.62	5.83]
[4.	7.07	0.	5.83	4.24]
[3.16	7.62	5.83	0.	2.]
[3.16	5.83	4.24	2.	0.]

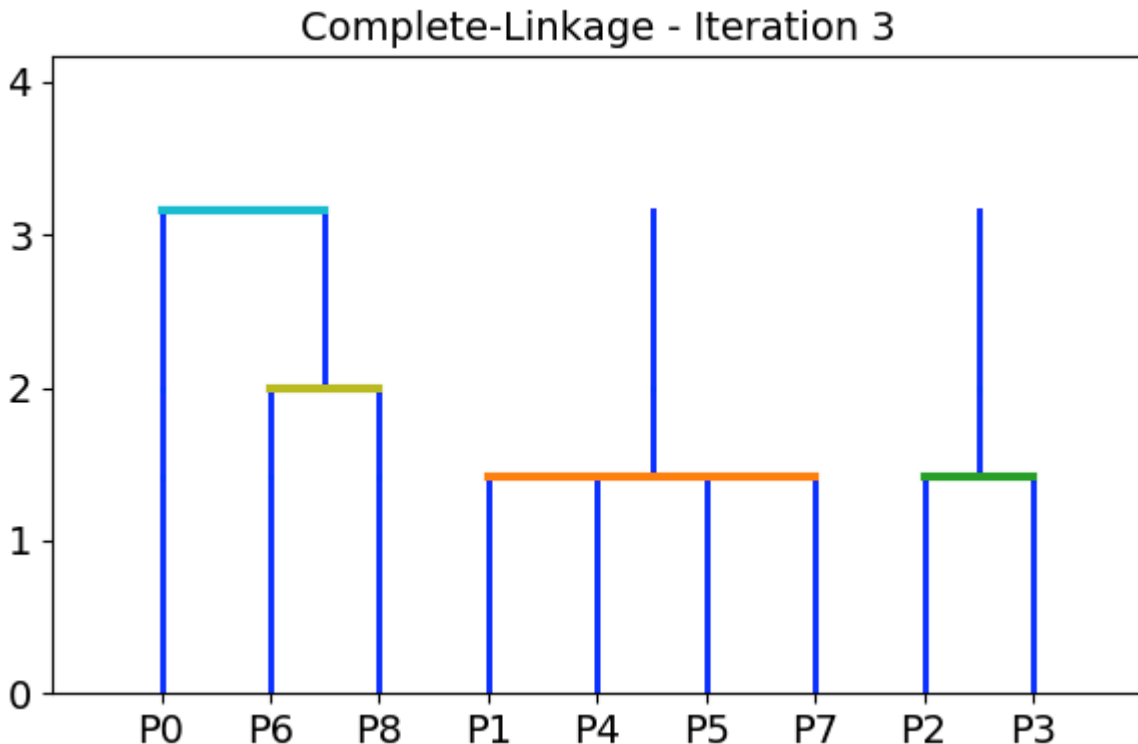
distance merge 2.00



Hierarchical: Complete-LINK- Euclidean Distance

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

distance merge 3.16

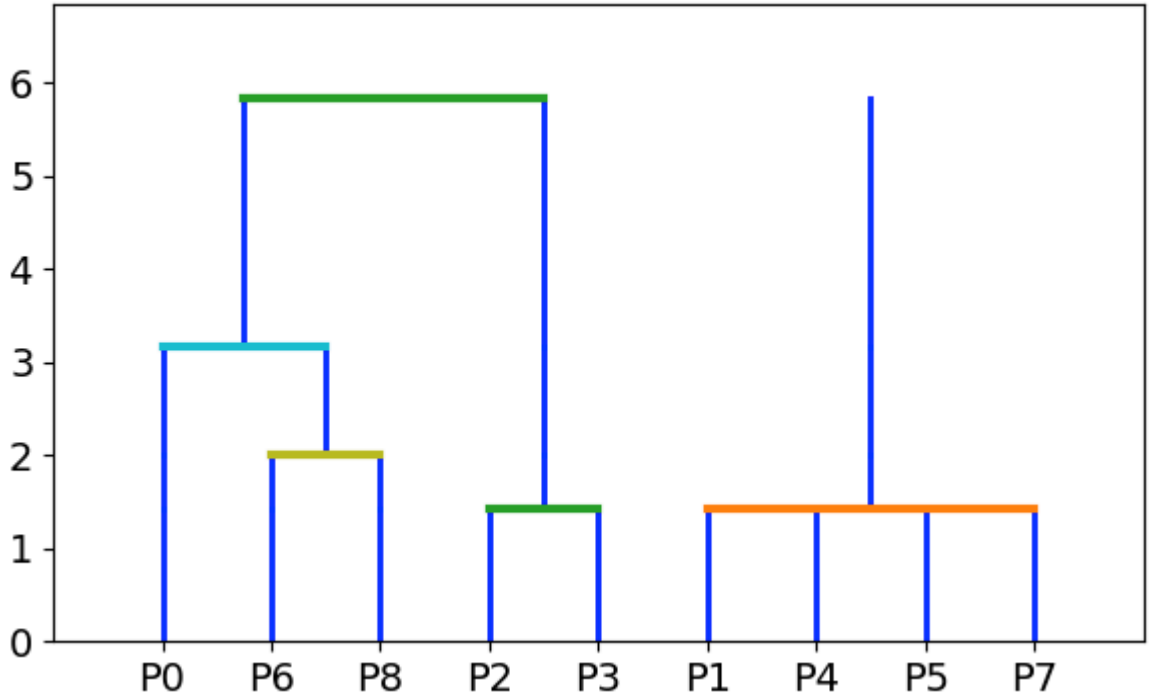


Hierarchical: Complete-LINK- Euclidean Distance

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

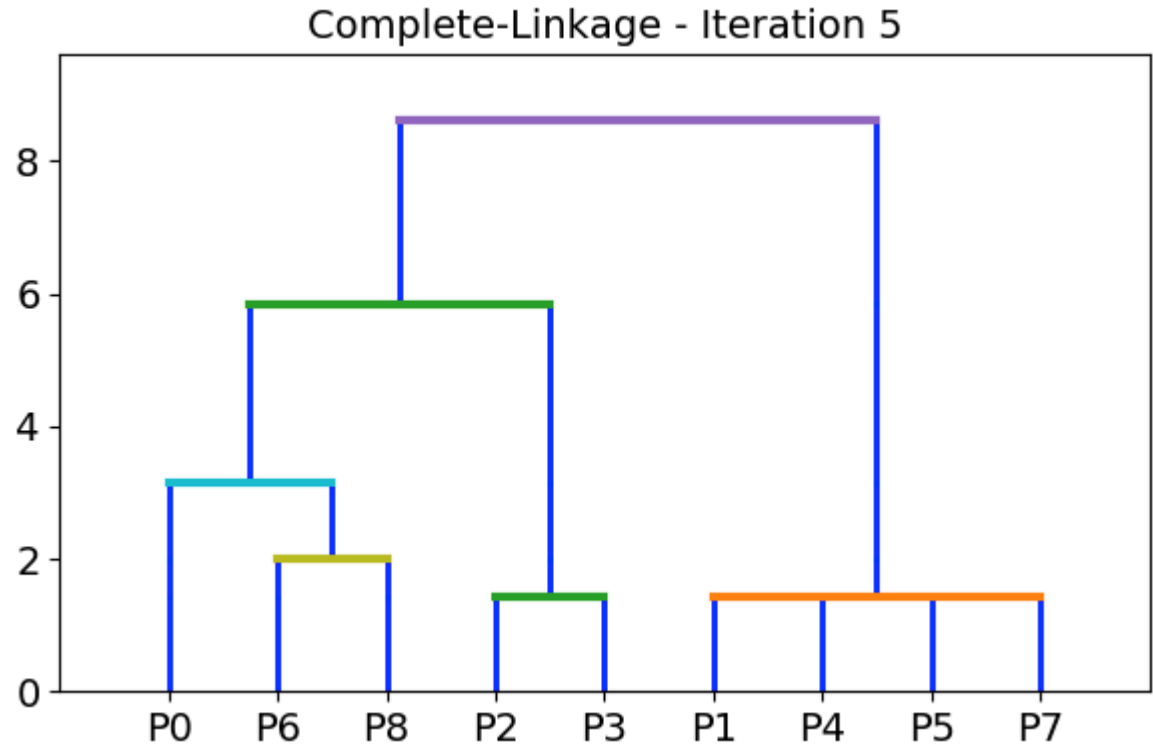
distance merge 5.83

Complete-Linkage - Iteration 4



Hierarchical: Complete-LINK- Euclidean Distance

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



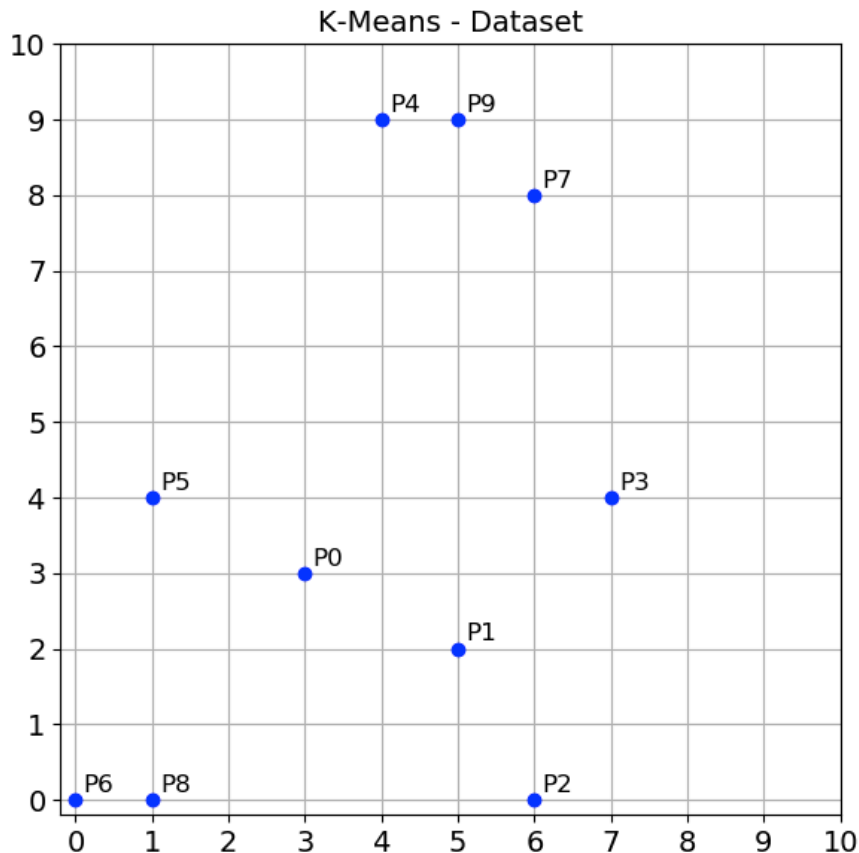
Exercise 2

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

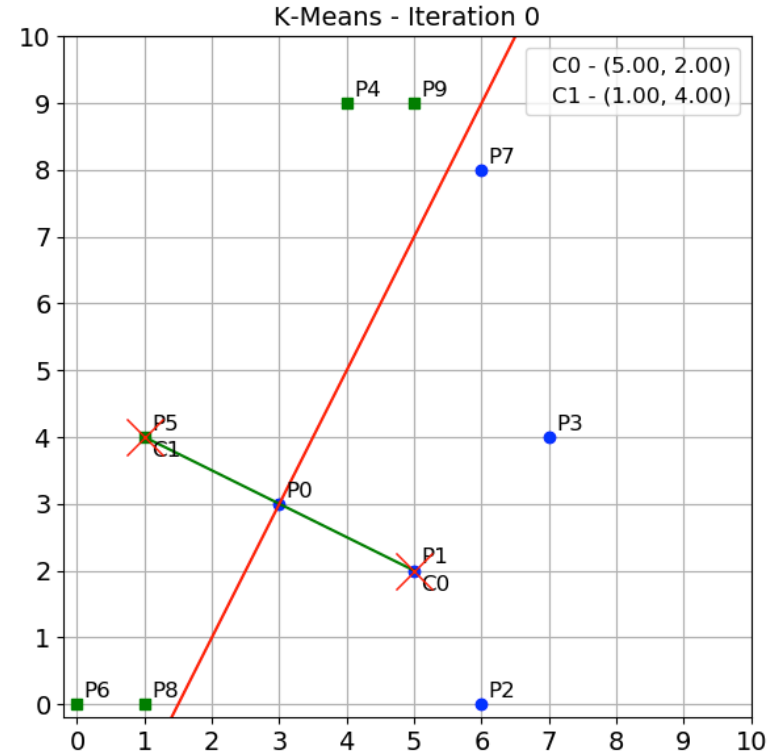
Cluster 1: P0,P1,P2,P3,P7

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

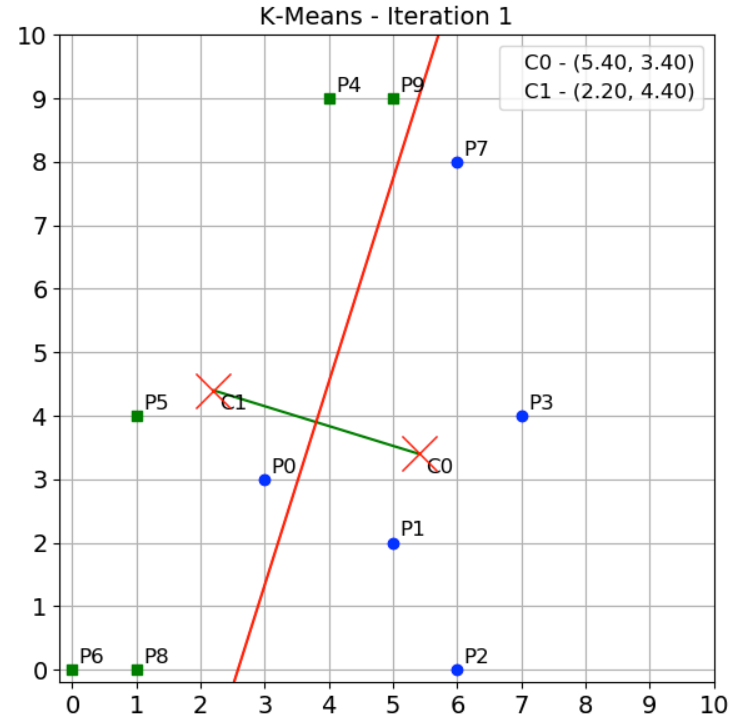
Cluster 1: P1,P2,P3,P7

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

Centrod1:

C1= (6.00, 3.50)

C2= (2.33, 4.17)

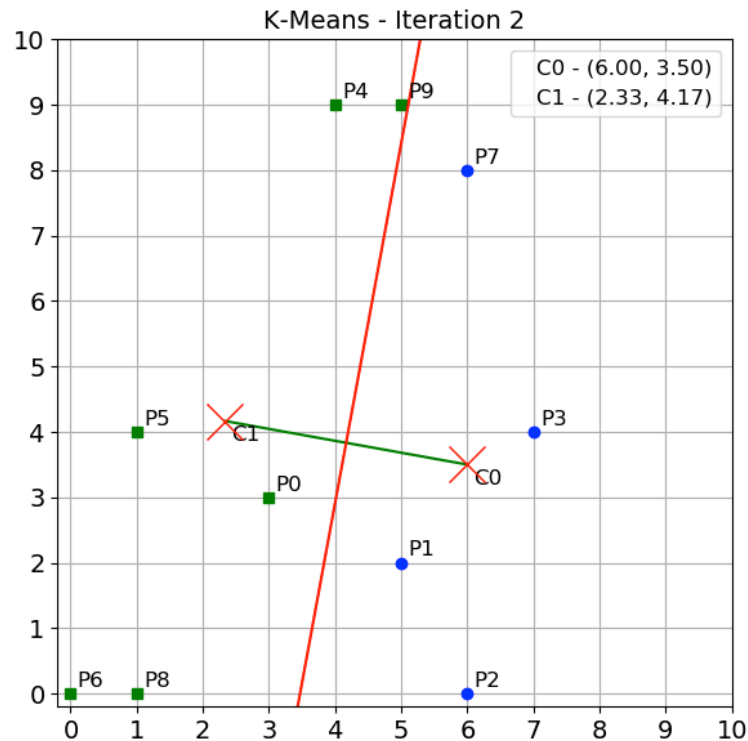


Solution: Identify the Bisecting lines dividing the plane between pairs of centroids

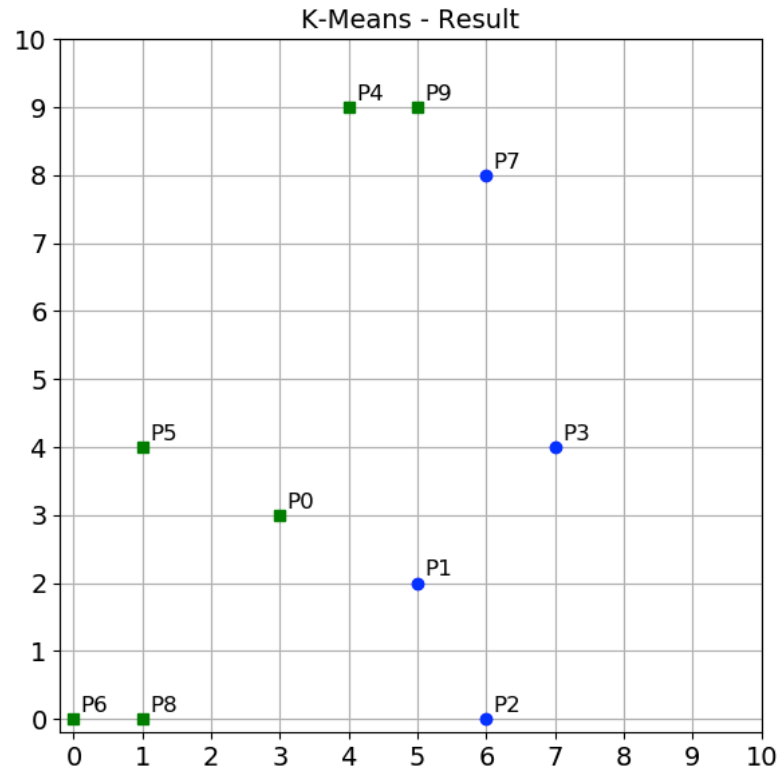
Cluster 1: P1,P2,P3,P7

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

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

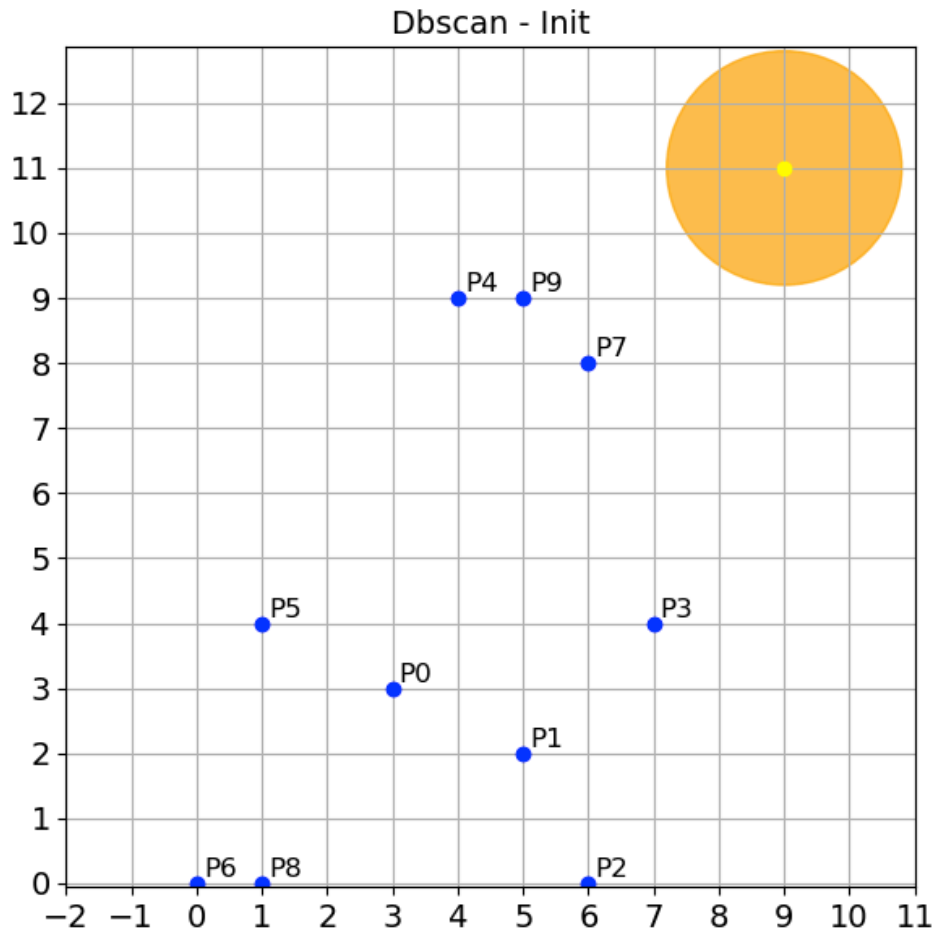


K-means result

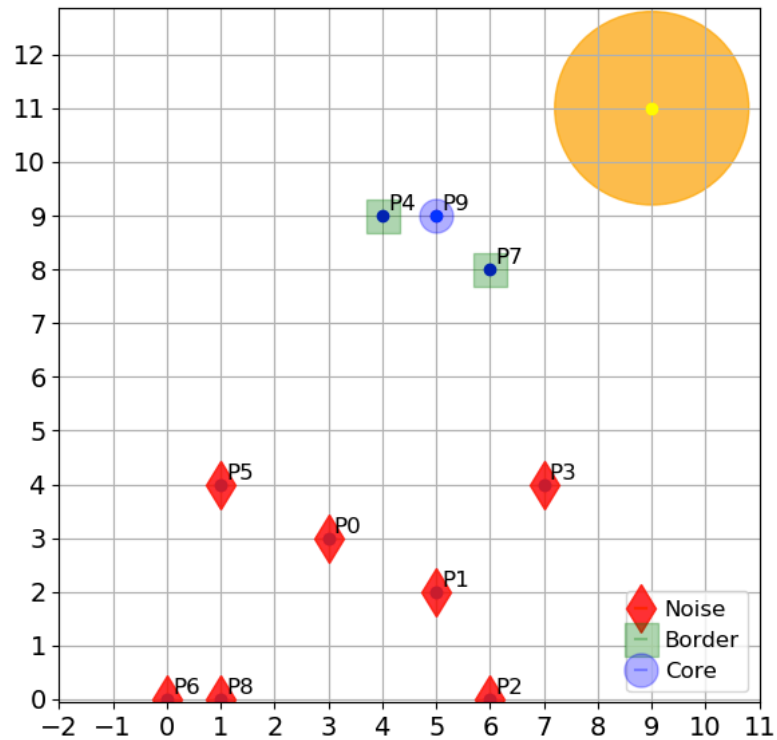


DBSCAN simulation

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



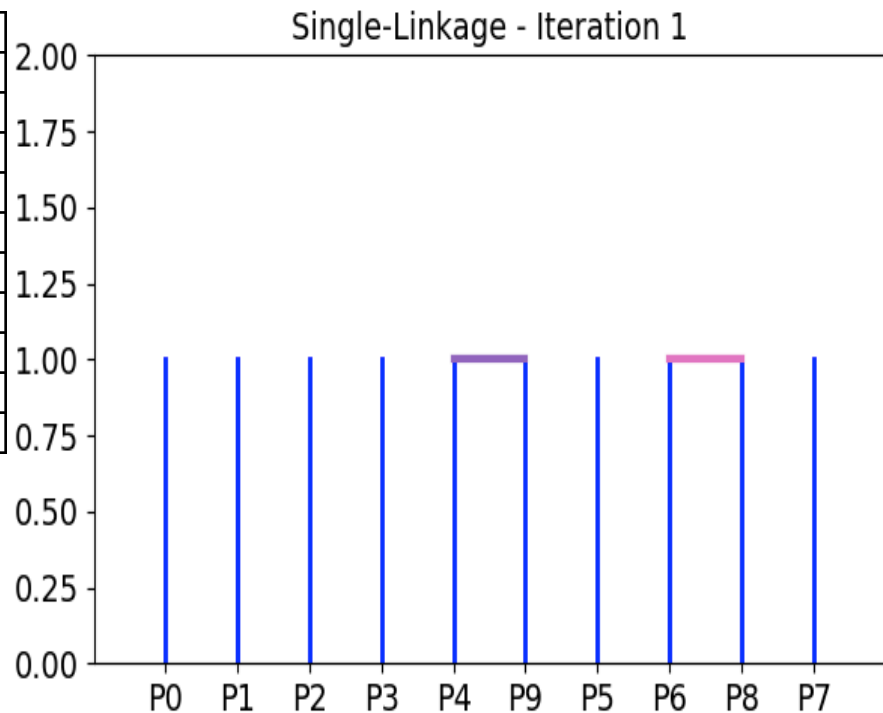
Dbscan - Noise Points



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.

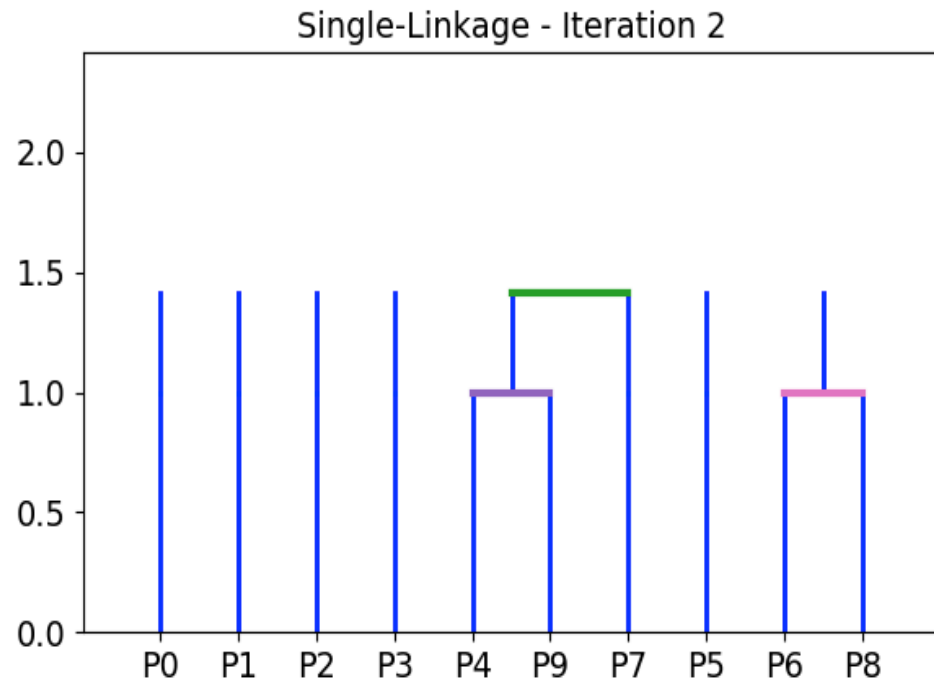
distance merge 1.00



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.]

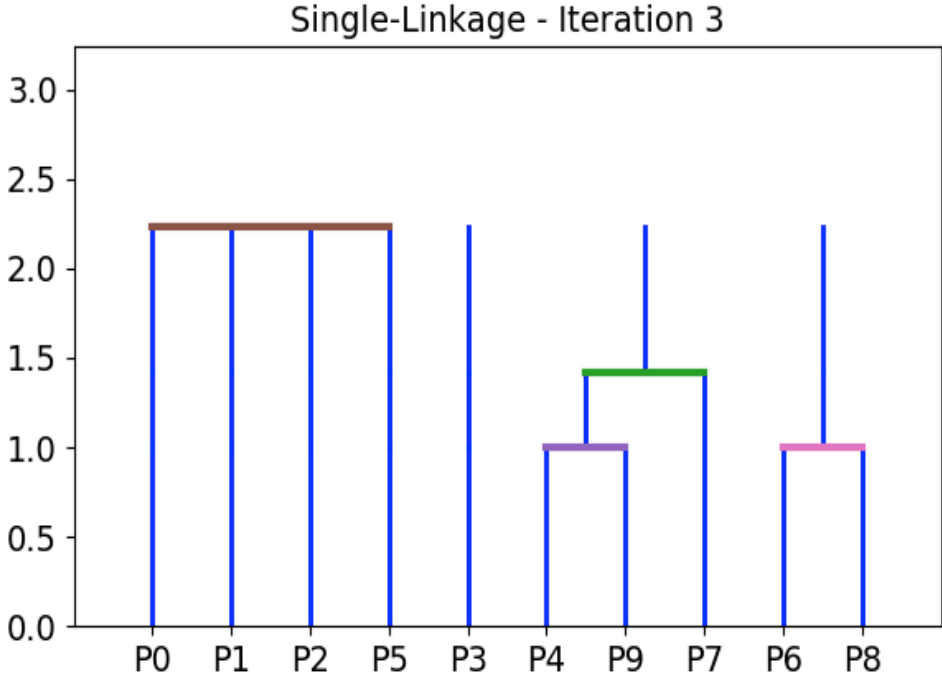
distance merge 1.41



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.]

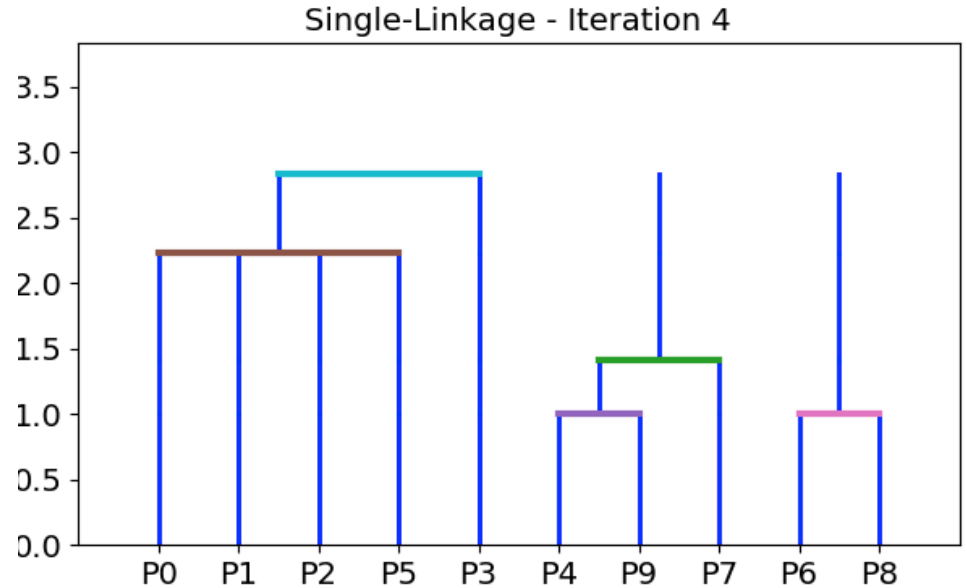
distance merge 2.24



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.]

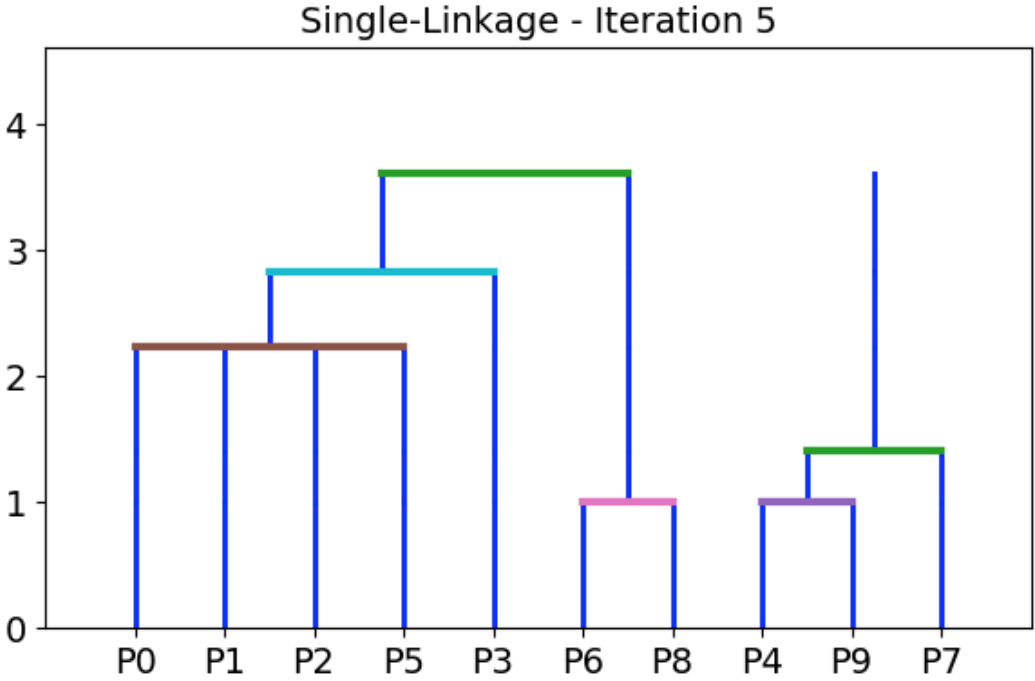
distance merge 2.83



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.]

