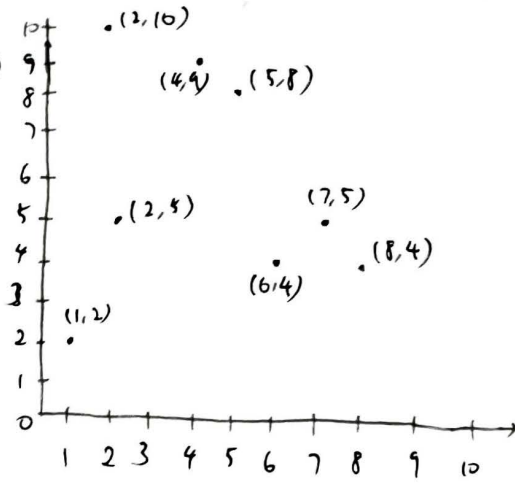
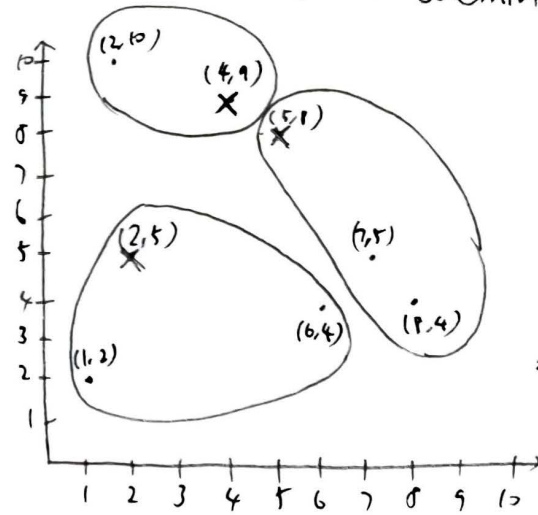


1. a)



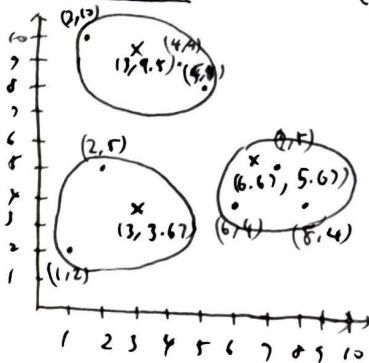
b)



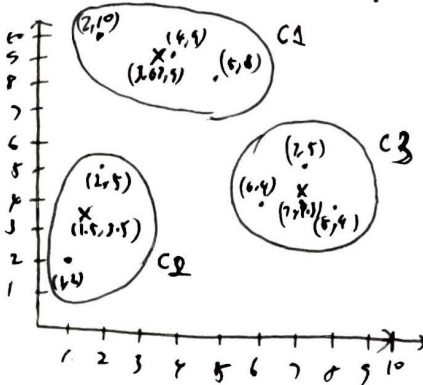
X = cluster centers.  
 $\{(2, 5), (5, 8), (4, 9)\}$

$\Rightarrow$  Iteration 1

c) Iteration 2: Centers:  $\{(3, 3.67), (6.67, 5.67), (3, 9.5)\}$



d) Iteration 3: Centers:  $\{(1.5, 3.5), (3.67, 9), (7, 4.33)\}$



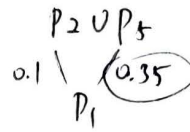
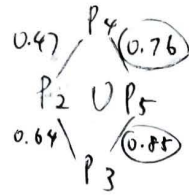
$\Rightarrow$  After 3 iterations, the centroids don't change anymore.  
 (or 2 more iterations from part b)

e) Resulting Centers:  $\{(1.5, 3.5), (3.67, 9), (7, 4.33)\}$

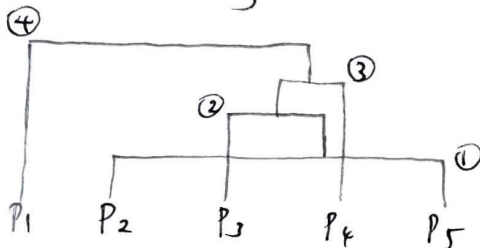
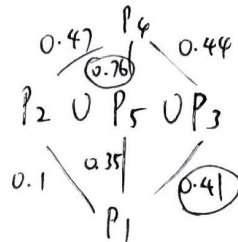
Resulting Clusters:  $\left\{ \begin{array}{l} \text{Cluster 1: } \{(2, 10), (4, 9), (5, 8)\} \\ \text{Cluster 2: } \{(1, 2), (2, 5)\} \\ \text{Cluster 3: } \{(6, 4), (7, 5), (8, 4)\} \end{array} \right.$

2. ① Single Link - choose the highest value (most similar)

	$P_2 \cup P_5$	$P_1$	$P_3$	$P_4$
$P_2 \cup P_5$	1	0.35	0.85	0.76
$P_1$	0.35	1	0.41	0.55
$P_3$	0.85	0.41	1	0.44
$P_4$	0.76	0.55	0.44	1



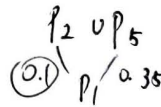
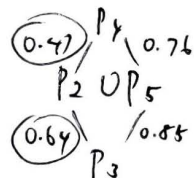
	$P_2 \cup P_5 \cup P_3$	$P_1$	$P_4$
$P_2 \cup P_5 \cup P_3$	1	0.41	0.76
$P_1$	0.41	1	0.55
$P_4$	0.76	0.55	1



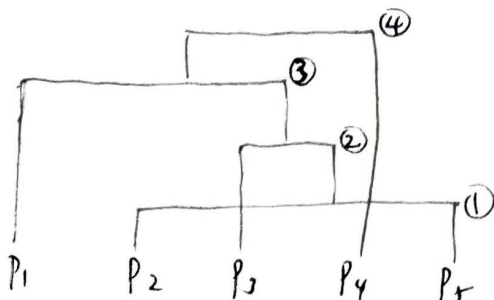
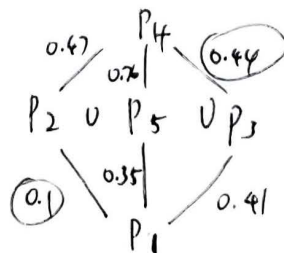
- ①  $P_2$  and  $P_5$
- ②  $P_3$  and  $P_2 \cup P_5$
- ③  $P_4$  and  $P_2 \cup P_5 \cup P_3$
- ④  $P_1$  and  $P_2 \cup P_5 \cup P_3 \cup P_4$

② Complete Link - choose the lowest value (least similar)

	$P_2 \cup P_5$	$P_1$	$P_3$	$P_4$
$P_2 \cup P_5$	1	0.1	0.64	0.47
$P_1$	0.1	1	0.41	0.55
$P_3$	0.64	0.41	1	0.44
$P_4$	0.47	0.55	0.44	1

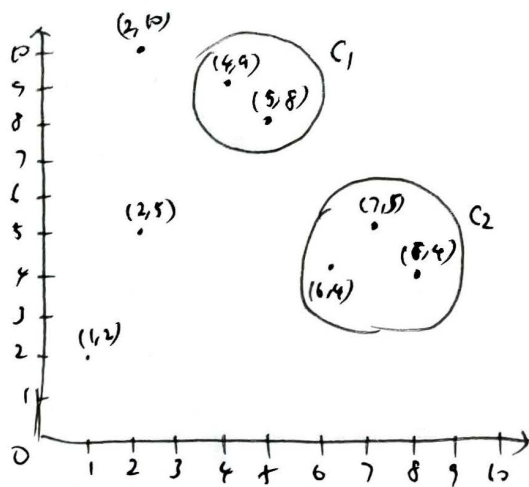


	$P_2 \cup P_5 \cup P_3$	$P_1$	$P_4$
$P_2 \cup P_5 \cup P_3$	1	0.1	0.44
$P_1$	0.1	1	0.55
$P_4$	0.44	0.55	1



- ①  $P_2$  and  $P_5$
- ②  $P_3$  and  $P_2 \cup P_5$
- ③  $P_1$  and  $P_2 \cup P_5 \cup P_3$
- ④  $P_4$  and  $P_2 \cup P_5 \cup P_3 \cup P_1$

3. a)



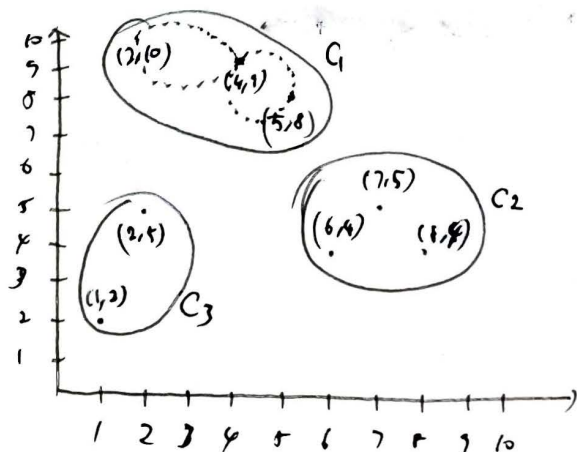
$$\epsilon = 2, \text{ min-samples} = 2$$

$$\text{Cluster 1} = \{(4, 9), (5, 8)\}$$

$$\text{Cluster 2} = \{(6, 4), (7, 5), (8, 4)\}$$

$$\text{Noise points} = \{(2, 10), (2, 5), (1, 2)\}$$

b)



$$\epsilon = \sqrt{10}, \text{ min-samples} = 2$$

$$\text{Cluster 1} = \{(2, 10), (4, 9), (5, 8)\}$$

$$\text{Cluster 2} = \{(6, 4), (7, 5), (8, 4)\}$$

$$\text{Cluster 3} = \{(1, 2), (2, 5)\}$$