

Question number 1:

	1	2	3	4	5
0	0				
1		0			
2	4	0			
3	6	9	0		
4	1	7	10	0	
5	6	3	5	8	0

The distance matrix can be interpreted as follow:

	1	2	3	4	5
1	0	4	6	1	6
2	4	0	9	7	3
3	6	9	0	10	5
4	1	7	10	0	8
5	6	3	5	8	0

This matrix will be referred to as D_1 from now-on.

→ We will now treat each object as its own cluster and commence by merging 2 closest objects.

	1	2	3	4	5
1	0	4	6	1	6
2	4	0	9	7	3
3	6	9	0	10	5
4	1	7	10	0	8
5	6	3	5	8	0

Merging 1 and 4 since they are the closest.

Single-linkage

$$\min(d_{if}) = d_{1,4} = 1.$$

$$\min(d_{ik}) = d_{1,4} = 1.$$

	(1,4)	2	3	5
(1,4)	0			
2	4	0		
3	6	9	0	
5	6	3	5	0

Choosing the minimum values from the matrix.

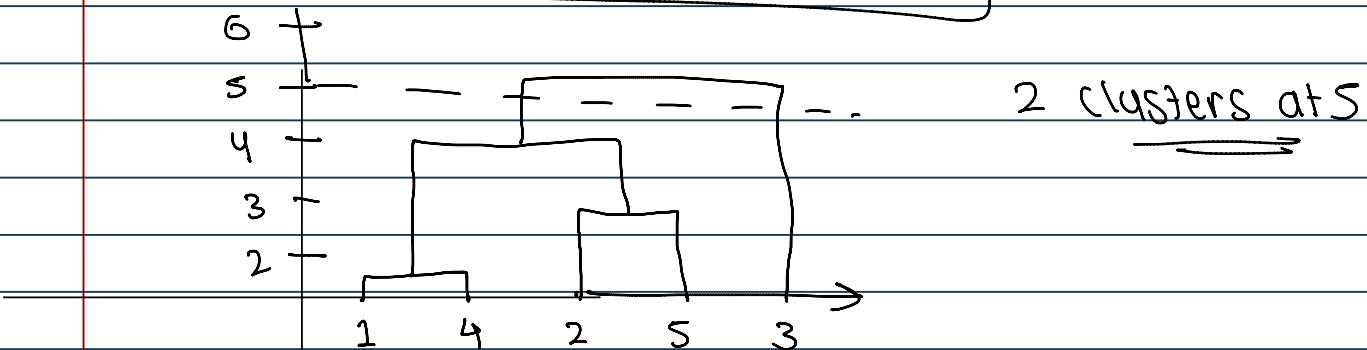
Merging 2 and 5 since they are the closest

	(1,4)	(2,5)	3
(1,4)	0		
(2,5)	4	0	
3	6	5	0

Merge (1,4) and (2,5) since they are the closest.

	((1,4), (2,5))	3
((1,4), (2,5))	0	
3	5	0

Dendrogram (Single)



Complete Linkage

In D_1 , we again have 1 and 4 has the closest points. However this time we choose maximum values.

	(1,4)	2	3	5
(1,4)	0			
2	7	0		
3	10	9	0	
5	8	3	5	0

Merge 2 and 5 since they are closest.

	(1,4)	(2,5)	3
(1,4)	0		
(2,5)	8	0	
3	10	9	0

Merge (1,4) and (2,5) since they are closest.

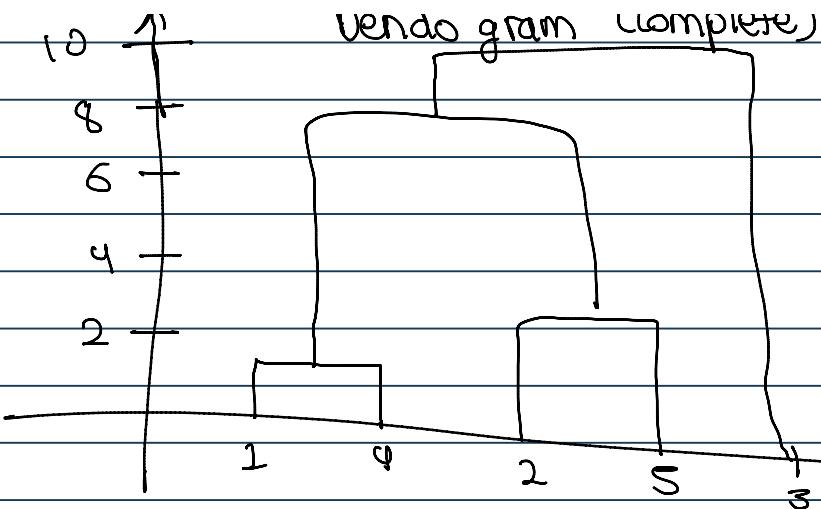
((1,4), (2,5)) 3

	0
3	0

10 ↑

Dendogram (Complete)

2 clusters



2 clusters
at 9.2

Average Linkage

We commence by merging 2 closest points in D_1 , i.e. 1 and 4

	(1,4)	2	3	5	
(1,4)	0				Taking average of all values
2	5.5	0			avg =
3	8	9	0		
5	7	3	5	0	

Merging 2 and 5 since they are closest
 $((1,4) \quad (2,5) \quad 3)$

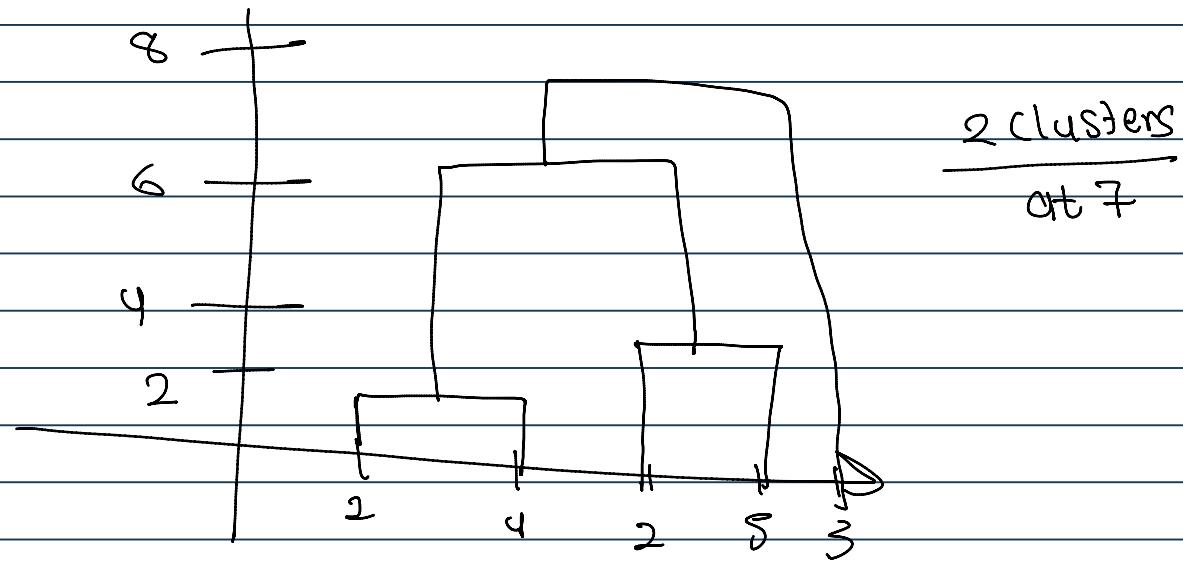
(1,4)	0			$\frac{5.5+7}{2}$
(2,5)	6.25	0		
3	8	7	0	$= \frac{9+5}{2} = 6$

Merging (1,4) and (2,5) since they are closest

Merging (1,4) and (2,5) since they are closest

$$\begin{array}{cc} ((1,4),(2,5)) & 3 \\ \left[\begin{array}{ccc} 0 & & \\ 7.5 & 0 & \end{array} \right] & \overline{\underline{7.5}} \\ 3 & \end{array}$$

Dendrogram



Since there are not a lot of features, the dendograms for single, average, and complete linkages are not very different.

In all of the dendograms initially, 1 and 4 are merged then 2 and 5 are merged.