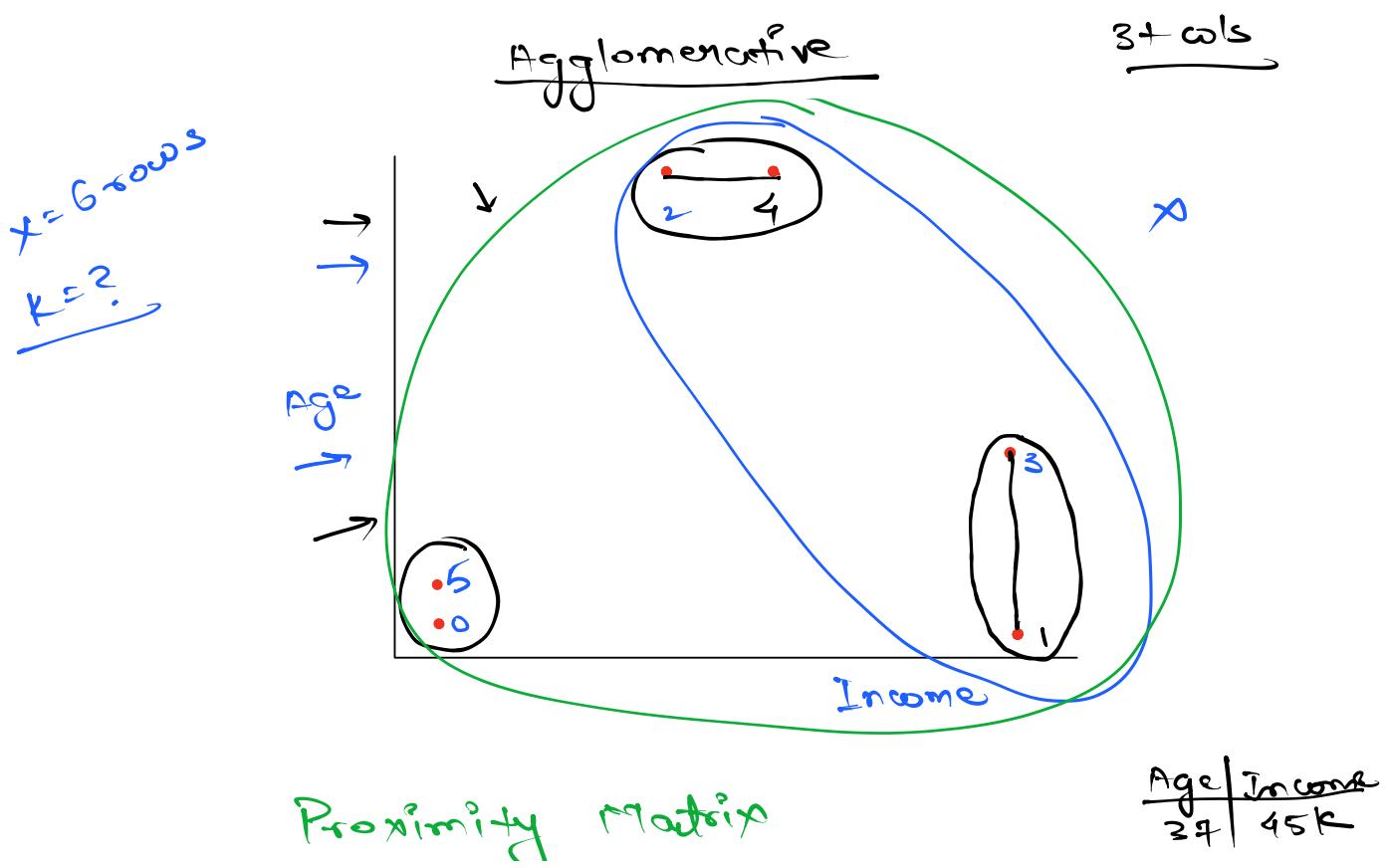


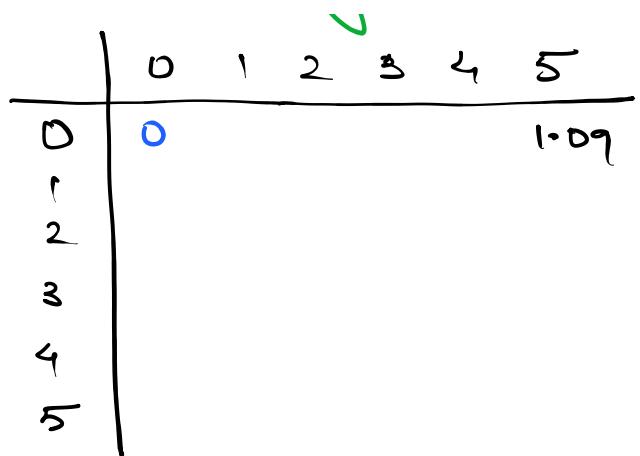
## Limitations of k-Means Clustering →

- ① Pre-defined k-value.
- ② Affected by the outliers.
- ③ It can only identify spherical/circular clusters because of centroid values.
- ④ Sometimes the elbow point graph does not give us the correct idea about the k-value.

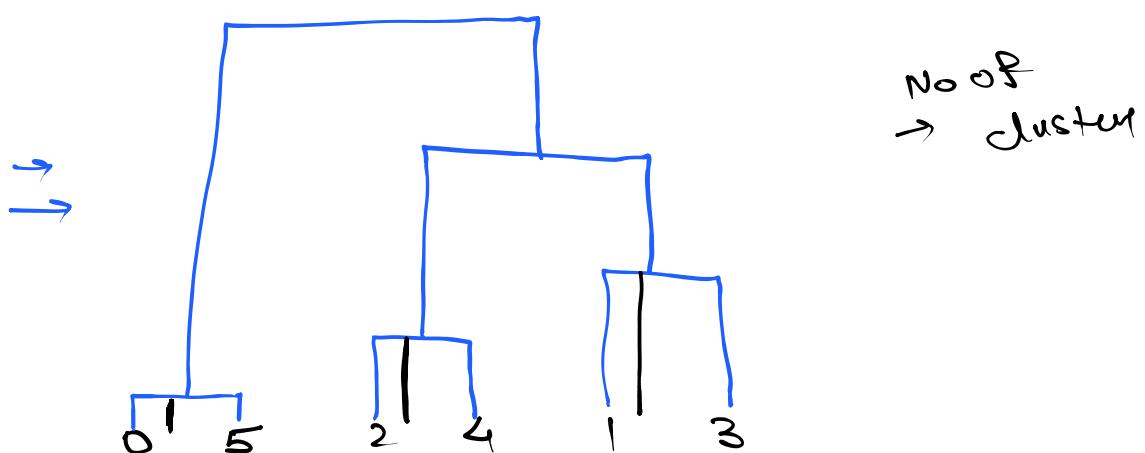
## Hierarchical Clustering →

- ① Agglomerative Approach.
- ② Divisive Approach.





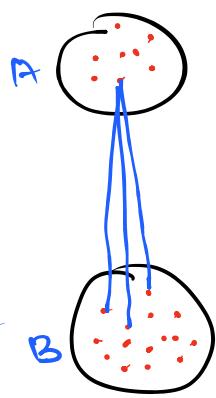
Dendrogram → Helps us to represent/visualize the clustering on the data stepwise



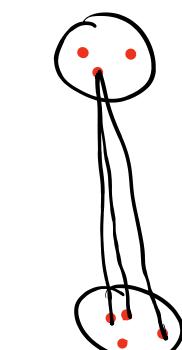
Types of Linkages →

- ① single Linkage
- ② Complete Linkage
- ③ Average Linkage
- ④ Ward Linkage

Mathematical working of agglomerative clustering →



	A	B	C	D	E
A	0	4	7	9	1
B	4	0	3	5	3
C	7	3	0	2	6
D	9	5	2	0	8
E	1	3	6	8	0



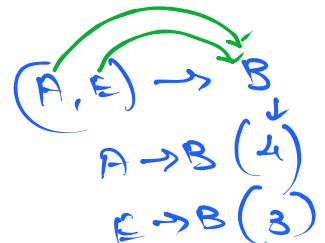
$$d_1^2 + d_2^2 + \dots + d_{12}^2$$

$\overbrace{A, E} \rightsquigarrow C$

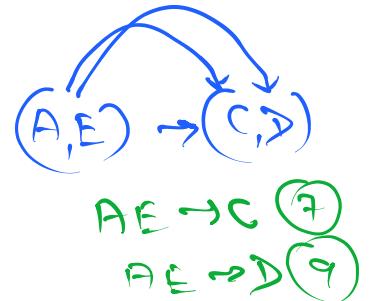
Linkages  
 single  
 complete

Initial Proximity Matrix

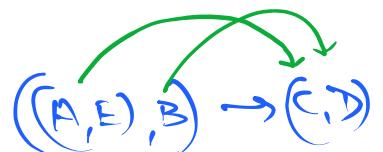
	(A, E)	B	C	D
(A, E)	0	4	7	9
B	4	0	3	5
C	7	3	0	2
D	9	5	2	0



	(A, E)	B	(C, D)
(A, E)	0	4	9
B	4	0	5
(C, D)	9	5	0

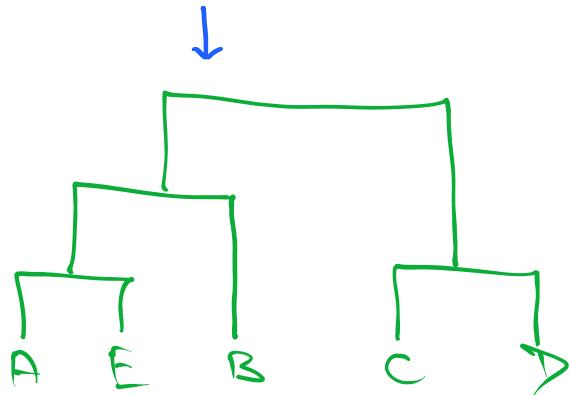


	((A, E), B)	(C, D)
((A, E), B)	0	9
(C, D)	9	0



(A, E) | (C, D)

$$\xrightarrow{\quad} \left[ ((A, E), B), (C, D) \right] \xleftarrow{\quad}$$



Resume at  
8:26