A] sketch the dendogram

Given dissimilarity matrix is

$$\begin{bmatrix} & 0.3 & 0.4 & 0.7 \\ 0.3 & & 0.5 & 0.8 \\ 0.4 & 0.5 & & 0.45 \\ 0.7 & 0.8 & 0.45 & \end{bmatrix}$$

We will use Principle Component Analysis for this.

1st step :

for $i=4$, we understand than 0.3 is the least dissimilarity, thus observations 1 & 2 are fused to form cluster (1,2). We can see below dissimilarity matrix after above step

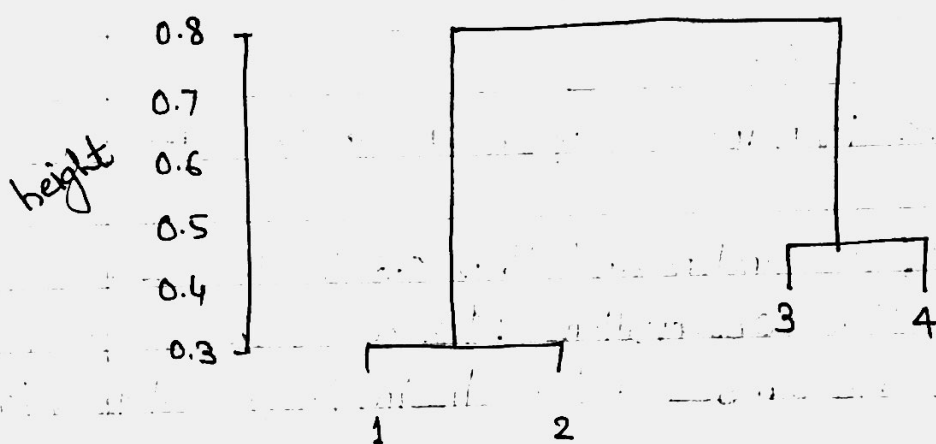$$\begin{bmatrix} & 0.5 & 0.8 \\ 0.5 & & 0.45 \\ 0.8 & 0.45 & \end{bmatrix}$$

2nd step:

For $i=3$, minimum dissimalinity is observed for 0.45. thus, we combine observations 3 & 4 to form a cluster (3,4). We can see new dissimilarity matrix as below

$$\begin{bmatrix} & 0.8 \\ 0.8 & \end{bmatrix}$$

3rd step:

At $i=4$, We combine both clusters $(1,2)$ & $(3,4)$ to form a new cluster $((1,2),(3,4))$ at height of 0.8

New cluster dendogram would be like below:

Cluster Dendogram

B] We will use linkage clustering for this. Given dissimilarity matrix is.

$$
\begin{bmatrix}
 & 0.3 & 0.4 & 0.7 \\
0.3 & & 0.5 & 0.8 \\
0.4 & 0.5 & & 0.45 \\
0.7 & 0.8 & 0.45 &
\end{bmatrix}
$$

1st step:-

0.3 is the minimum dissimilarity in the matrix thus, we combine observations 1 & 2 to form a new cluster (1,2) at height of 0.3. The new dissimilarity matrix after step 1.

$$\begin{bmatrix} & 0.4 & 0.7 \\ 0.4 & & 0.45 \\ 0.7 & 0.45 & \end{bmatrix}$$
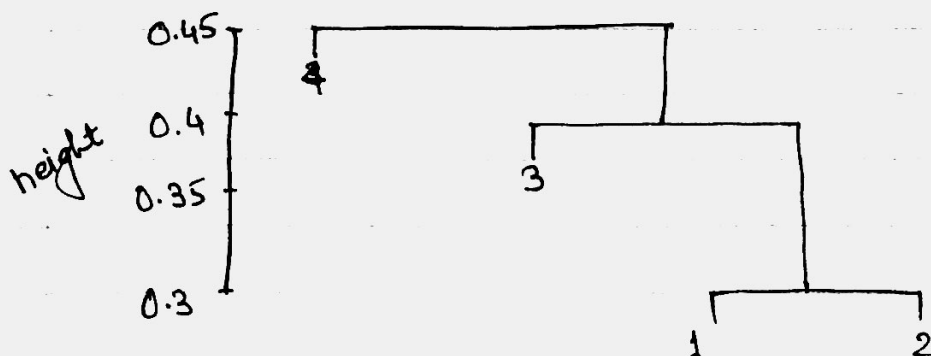
2nd step:-

For above matrix 0.4 is the minimum dissimilarity. So, we decided to combine cluster (1,2) & observation 3 to form new cluster ((1,2),3). New dissimilarity post step 2.

$$\begin{bmatrix} & 0.45 \\ 0.45 & \end{bmatrix}$$

3rd step:-

Here we fuse cluster ((1,2),3) & observation 4, which combines new cluster et(((1,2),3),4) at level 0.45

Cluster Dendogram

C] If we cut the dendogram created in ⓐ into 2, then we will have two clusters like
$$(1,2) \ \& \ (3,4)$$

D] If we cut the dendogram created in ⓑ into 2, then we will have two clusters like.
$$((1,2),3) \ \& \ (4)$$

E]

Height

Cluster Dendogram