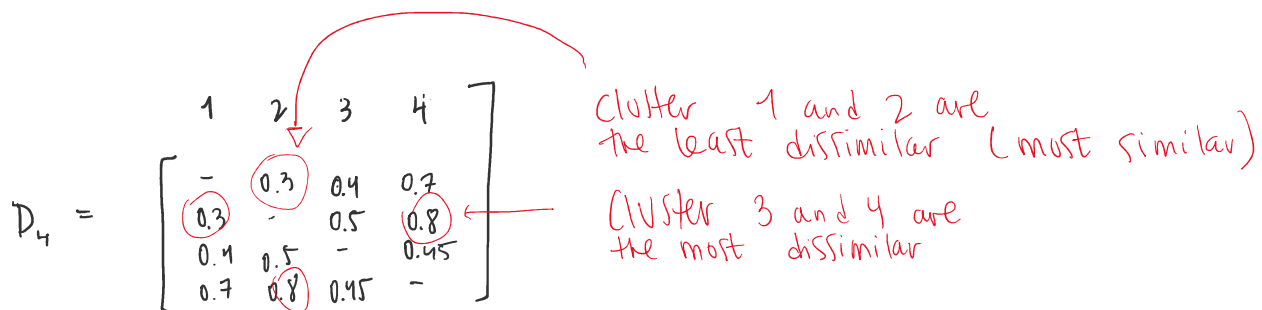
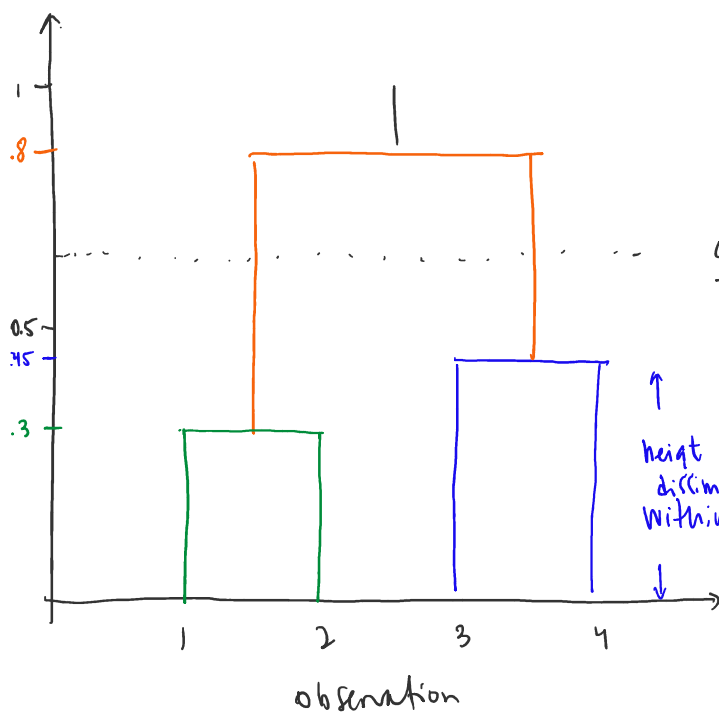


- (a) Sketch the dendrogram that result from hierarchically clustering the four observation using complete linkage see in Algo 10.2 ISLR



dissimilarity

 $i = 4$

- (a) Fuse the two least dissimilar (most similar) clusters:

→ Cluster $\{1\}$ and $\{2\}$ are the most similar, with a dissimilarity of 0.3

(b) compute the new pairwise inter-cluster dissimilarities among the 3 resulting clusters using complete linkage:

→ complete linkage: the dissimilarity between the new cluster $\{1,2\}$ and the remaining clusters $\{3\}$ and $\{4\}$ the largest pairwise dissimilarity

$$D_3 = \begin{matrix} & \{1,2\} & 3 & 4 \\ \begin{matrix} \{1,2\} \\ 3 \\ 4 \end{matrix} & \begin{bmatrix} - & 0.5 & 0.8 \\ 0.5 & - & 0.45 \\ 0.8 & 0.45 & - \end{bmatrix} \end{matrix}$$

$\max \{(D_4)_{13}, (D_4)_{23}\} = \max \{0.4, 0.5\}$

$= (D_4)_{34}$ Since cluster 3 and 4 is not fused.

$i = 3$

(a) Fuse cluster 3 and 4 (dissimilarity = 0.45)

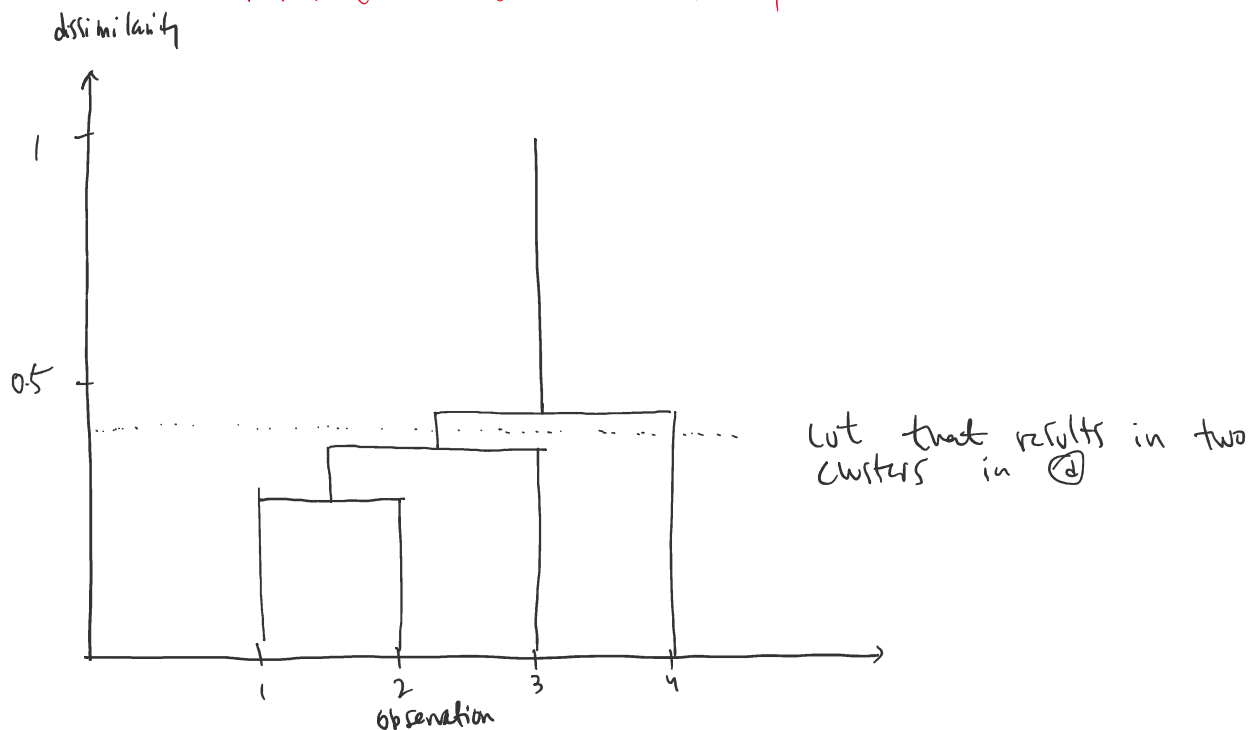
(b) Update pairwise dissimilarities:

$$D_2 = \begin{matrix} & \{1,2\} & \{3,4\} \\ \begin{matrix} \{1,2\} \\ \{3,4\} \end{matrix} & \begin{bmatrix} - & 0.8 \\ 0.8 & - \end{bmatrix} \end{matrix}$$

$i = 2$

(a) Fuse $\{1,2\}$ and $\{3,4\}$ (dissimilarity = 0.8)

- (b) Sketch a dendrogram using single linkage clustering
 ↳ minimal intercluster similarity



$i=4$

- (a) Fuse cluster 1 and 2
 (b) Update dissimilarity matrix using single linkage

$$D_3 = \begin{matrix} & \{1,2\} & 3 & 4 \\ \begin{bmatrix} - & 0.4 & 0.7 \\ 0.4 & - & 0.45 \\ 0.7 & 0.45 & - \end{bmatrix} \end{matrix}$$

$i=3$

- (a) Fuse cluster $\{1,2\}$ and 3
 (b) update dissimilarity matrix

$$D_2 = \begin{matrix} & \{1,2,3\} & 4 \\ \begin{bmatrix} - & 0,45 \\ 0,45 & - \end{bmatrix} \end{matrix}$$

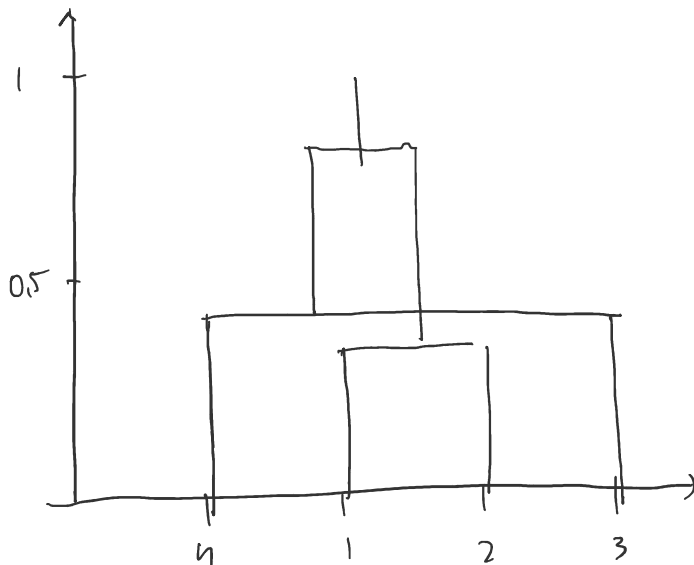
i=2 Fuse $\{1,2,3\}$ and 4

① If we cut the dendrogram in ① such that two clusters C_1 and C_2 results, the observations are assign to clusters:

$$C_1 = \{1, 2\} \quad C_2 = \{3, 4\}$$

② $C_1 = \{1, 2, 3\} \quad C_2 = \{4\}$

③ Sketch the dendrogram in ② after swapping the positions of two clusters:



η 1 2 3