Q1. First we obtain the distance matrix

	A	B	C	D	E	F
A	0	0.71	5.66	3.61	4.24	3.20
B	0.71	0	4.95	2.92	3.54	2.50
C	5.66	4.95	0	2.24	1.41	2.25
D	3.61	2.92	2.24	0	1.00	0.50
E	4.24	3.54	1.41	1.00	0	1.12
F	3.20	2.50	2.50	0.50	1.12	0

In single linkage, minimum distance between clusters

1. Lowest $\longrightarrow$ (D,F) = 0.5
   Clusters $\longrightarrow$ {A, B, C, E, (D, F)}

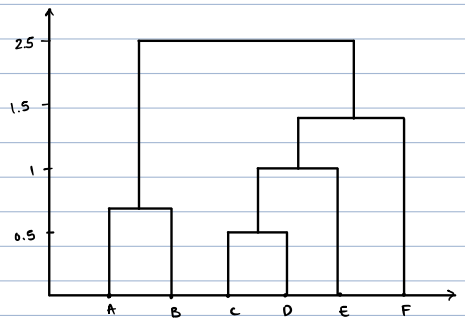
2. Lowest $\longrightarrow$ (A,B) = 0.71
   Clusters $\longrightarrow$ {(A,B), C, E, (D,F)}

3. Lowest $\longrightarrow$ (D,E) = 1.0
   Clusters $\longrightarrow$ {(A,B), C, (E, (D,F))}

4. Lowest $\longrightarrow$ (C,E) = 1.41
   Clusters $\longrightarrow$ {(A,B), (C, (E, (D,F)))}

5. Last joining has to be the two remaining clusters.

Dendrogram:



2. Random membership matrix

	A	B	C	D	E	F
c_1	0.5	0.2	0.1	0.3	0.2	0.9
c_2	0.2	0.9	0.5	0.5	0.8	0.2

Consider fuzzy parameter $n = 2$.

[computations done on python]

1. $c_1 = (4.66, 7.83)$, $c_2 = (3.37, 5.97)$

$$\text{matrix} = \begin{matrix} A & B & C & D & E & F \end{matrix} \begin{bmatrix} 0.37 & 0.30 & 0.55 & 0.34 & 0.68 & 0.69 \\ 0.63 & 0.69 & 0.44 & 0.65 & 0.31 & 0.30 \end{bmatrix}$$

2. $c_1 = (4.33, 7.36)$, $c_2 = (2.77, 5.67)$

$$\text{matrix} = \begin{bmatrix} 0.33 & 0.23 & 0.61 & 0.38 & 0.77 & 0.66 \\ 0.66 & 0.76 & 0.38 & 0.61 & 0.22 & 0.33 \end{bmatrix}$$

3. $c_1 = (4.38, 7.34)$, $c_2 = (2.62, 5.61)$

$$\text{matrix} = \begin{bmatrix} 0.31 & 0.20 & 0.61 & 0.38 & 0.79 & 0.67 \\ 0.68 & 0.79 & 0.38 & 0.61 & 0.20 & 0.32 \end{bmatrix}$$

probability for cluster 2

probability for cluster 1