

Home Assignment - 4

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(Q1). Given

	X	Y
P ₁	0.4	0.5
P ₂	0.2	0.3
P ₃	0.1	0.08
P ₄	0.21	0.12
P ₅	0.6	0.16
P ₆	0.33	0.28
P ₇	0.11	0.15

	P ₁	P ₂	P ₃	P ₄	P ₅	P ₆	P ₇
P ₁	0						
P ₂	0.282	0					
P ₃	0.516	0.2417	0				
P ₄	0.424	0.1803	0.117	0			
P ₅	0.394	0.423	0.806	0.392	0		
P ₆	0.230	0.131	0.305	0.2	0.295	0	
P ₇	0.454	0.175	0.0903	0.104	0.49	0.256	0

Distance

$$(P_1, P_2) = \sqrt{(0.2)^2 + (0.2)^2} = 0.2\sqrt{2} = 0.282$$

$$(P_1, P_3) = 0.516$$

$$(P_1, P_4) = 0.424$$

$$(P_1, P_5) = 0.394$$

$$(P_1, P_6) = 0.230$$

$$(P_1, P_7) = 0.4545$$

$$(P_2, P_3) = 0.2417$$

$$(P_2, P_4) = 0.1803$$

$$(P_2, P_5) = 0.4237$$

$$(P_2, P_6) = 0.131$$

$$(P_2, P_7) = 0.175$$

$$(P_3, P_4) = 0.117$$

$$(P_3, P_5) = 0.506$$

$$(P_3, P_6) = 0.305$$

$$(P_3, P_7) = 0.0707$$

$$(P_4, P_5) = 0.392$$

$$(P_4, P_6) = 0.2$$

$$(P_4, P_7) = 0.104$$

$$(P_5, P_6) = 0.295$$

$$(P_5, P_7) = 0.49$$

$$(P_6, P_7) = 0.256$$

MIN Link

closest pair is (P_3, P_7) cluster A

$$d(A, P_1) = \min[d(P_1, P_3), d(P_1, P_7)]$$

$$= 0.516, 0.454 = 0.454$$

$$\boxed{P_3 \quad P_7}$$

$$d(A, P_2) = \min[d(P_3, P_2), d(P_7, P_2)]$$

$$= 0.175$$

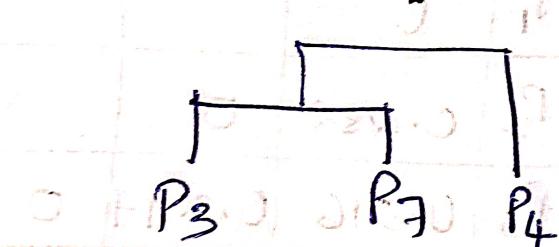
$$d(A, P_4) = 0.117$$

$$d(A, P_5) = 0.49$$

$$d(A, P_6) = 0.2$$

$$\text{smallest is } d(A, P_4) = 0.117$$

- cluster B



$$d(B, P_1) = \min((P_3, P_4, P_7), P_1)$$

$$= 0.424$$

$$d(B, P_2) = \min((P_3, P_4, P_7), P_2)$$

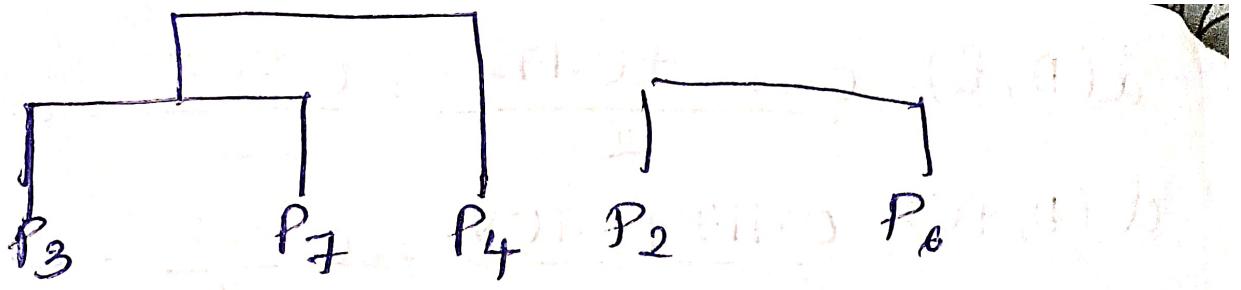
$$= 0.175$$

$$d(B, P_5) = \min((P_3, P_4, P_7), P_5)$$

$$= 0.392$$

$$d(B, P_6) = \min((P_3, P_4, P_7), P_6)$$

$$d(P_2, P_6) = 0.131 \text{ is minimum}$$

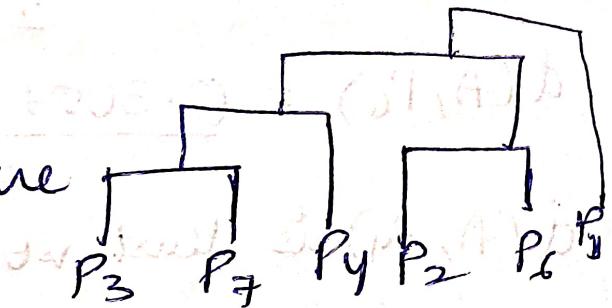


so cluster c ($(P_3, P_7, P_4, P_2, P_6)$)

$$d[c, p_1] = 0.230$$

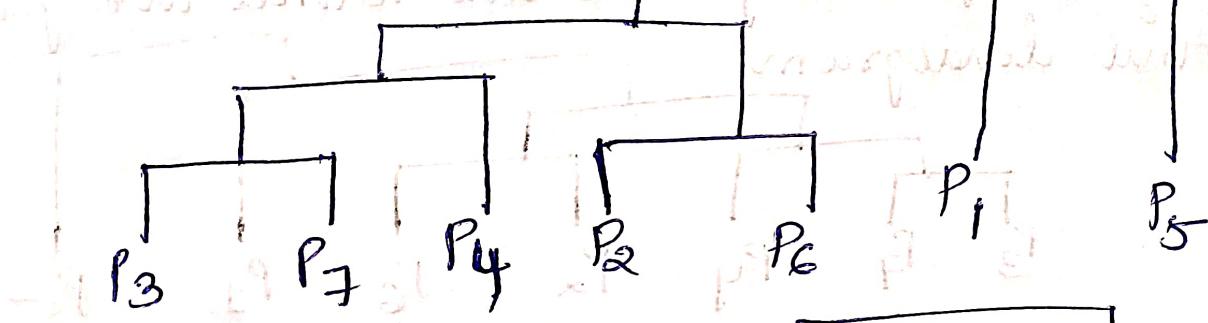
$$d[c, p_5] = 0.295$$

so p_1 is the least value

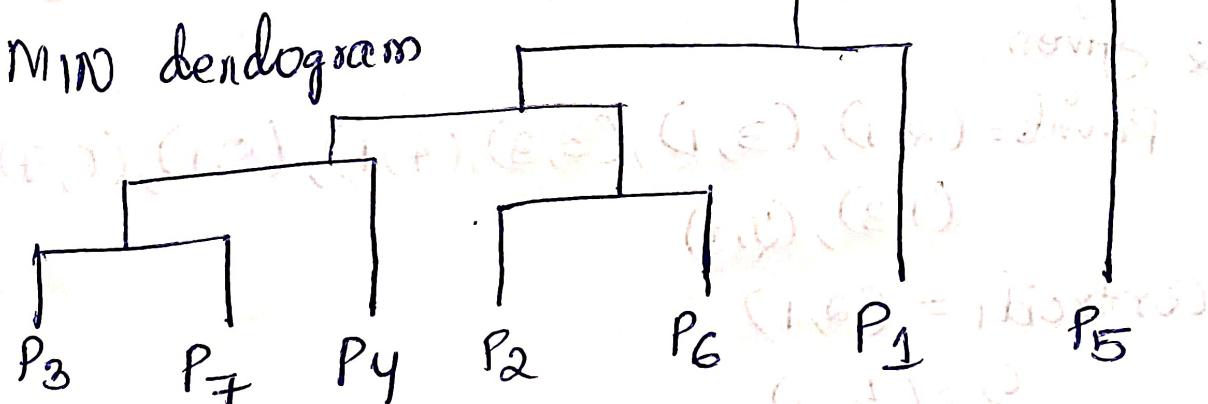


and next p_5

so final dendrogram

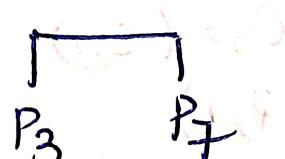


MINO dendrogram



Average link

closest pair (P_3, P_7) cluster A



$$d(A, P_1) = \frac{0.516 + 0.454}{2} = \frac{0.97}{2} = 0.485$$

$$d(A, P_2) = \frac{0.282 + 0.175}{2} = \frac{0.457}{2} = 0.2285$$

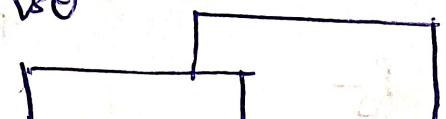
$$d(A, P_4) = \frac{0.117 + 0.104}{2} = \frac{0.221}{2} = 0.1105$$

$$d(A, P_5) = \frac{0.506 + 0.49}{2} = \frac{0.996}{2} = 0.498$$

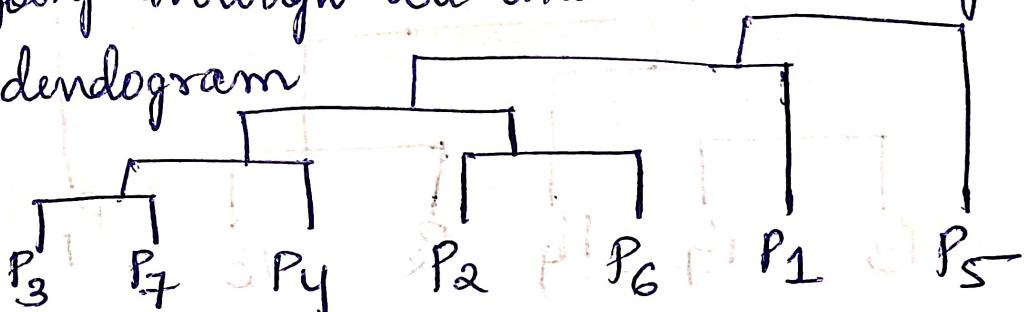
$$d(A, P_6) = \frac{0.305 + 0.286}{2} = \frac{0.561}{2} = 0.2805$$

$d(A, P_4)$ is least

cluster B



After going through all the vertices we get final dendrogram



Q2 given

points = $(2, 1), (3, 1), (3, 3), (4, 1), (5, 1), (6, 7), (1, 3), (9, 5)$

$$\text{Centroid } C_1 = (2, 1)$$

$$C_2 = (4, 1)$$

$$C_3 = (5, 1)$$

Point $(9, 1)$

Distance to $C_1 = 0$ Assign to C_1

$$C_2 = 2$$

$$C_3 = 3$$

Point (3, 1)

Distance to $c_1 = 1$

$c_2 = 1$ assign to c_1

$c_3 = 2$

Point (3, 3)

Distance to $c_1 = \sqrt{5}$

$c_2 = \sqrt{5}$

$c_3 = \sqrt{8}$

Assign to c_1

Point (4, 1)

Distance to $c_1 = 2$

$c_2 = 0$

$c_3 = 1$

Assign to c_2

(5, 1)

Distance to $c_1 = 3$ Assign to c_3

$c_2 = 1$

$c_3 = 0$

(6, 7)

Distance to $c_1 = \sqrt{52}$ Assign to c_3

$c_2 = \sqrt{40}$

$c_3 = \sqrt{37}$

(1, 3)

Distance to $c_1 = \sqrt{5}$

$c_2 = \sqrt{13}$

$c_3 = \sqrt{20}$

Assign to c_1

$$C_2 = (2, 5)$$

Distance to $C_1 = 4$ Assign to c_1
 $C_2 = \sqrt{20}$
 $c_3 = 5$

$$\text{New centroid } a = \left(\frac{2+3+3+1+1}{5}, \frac{1+1+3+5}{5} \right) \\ = (1.8, 2.6)$$

$$C_2 = (4, 1)$$

$$C_3 = \left(\frac{5+6}{2}, \frac{7+1}{2} \right) = (5.5, 4)$$