

Assignment - I

①

	M	N	P	Q	R	
A	1	2	3	4	5	
B	2	3	2	5	3	
C	5	5	5	3	2	

$$\text{Avg } q = \frac{9}{3} = 3$$

$$B = \frac{15}{5} = 3$$

$$C = \frac{20}{5} = 4$$

M N P Q R

A	-2	-1	0	1	2
B	-1	0	-1	2	0
C	1	1	1	-1	-2

substituting the average for each column,

$$\text{Avg. } q \text{ M} = -2/3 = 0.66$$

$$N = 0; P = 0; Q = 2/3 = 0.66; R = 0$$

M N P Q R

A	$-\frac{4}{3}$	-1	0	$\frac{1}{3}$	2
B	$-\frac{1}{3}$	0	-1	$\frac{4}{3}$	0
C	$\frac{5}{3}$	1	1	$-\frac{5}{3}$	-2

Shot on OnePlus

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Longest element = 2,  $(C, P) = 1$

③

	a	b	c	d	e	f	g	h
A	4	5	5	5	1		3	2
B		3	4	3	1	2	1	
C	2		1	3		4	5	3

updating 3,4,5 to 1; 1,2 empty to 0

	a	b	c	d	e	f	g	h
A	1	1	0	1	0	0	1	0
B	0	1	1	1	0	0	0	0
C	0	0	0	1	0	1	1	1

Jaccard distance  $\text{JD}(a, b) = 1 - \frac{\sum a_i b_i}{\sum a_i + \sum b_i} = 1 - \frac{1}{2} = \frac{1}{2}$

$$\text{JD}(a, c) = 1 - 1 = 0$$

$$\text{JD}(a, d) = 1 - \frac{1}{3} = \frac{2}{3}$$

$$\text{JD}(a, e) = 1 - 0 = 1$$

$$\text{JD}(a, f) = 1 - 0 = 1$$

$$\text{JD}(a, g) = 1 - \frac{1}{2} = \frac{1}{2}$$

$$\text{JD}(a, h) = 1 - 0 = 1$$

$$\text{JD}(b, c) = 1 - \frac{1}{2} = \frac{1}{2}$$

$$\text{JD}(b, d) = 1 - \frac{2}{3} = \frac{1}{3}$$

$$\text{JD}(b, e) = 1 - 0 = 1$$

$$\text{JD}(b, f) = 1 - 0 = 1$$

$$\text{JD}(b, g) = 1 - \frac{1}{3} = \frac{2}{3}$$

$$\text{JD}(b, h) = 1 - \emptyset = 1$$

$$\text{JD}(d, b) = 1 - \frac{1}{3} = \frac{2}{3}$$

$$\text{JD}(e, g) = 1 - 0 = 1$$

$$\text{JD}(f, g) = 1 - \frac{1}{2} = \frac{1}{2}$$

$$\text{JD}(g, h) = 1 - \frac{1}{2} = \frac{1}{2}$$

$$\text{JD}(h, b) = 1 - 0 = 1$$

$$\text{JD}(c, e) = 1 - 0 = 1$$

$$\text{JD}(c, g) = 1 - 0 = 1$$

$$\text{JD}(d, e) = 1 - 0 = 1$$

$$\text{JD}(d, g) = 1 - \frac{1}{3} = \frac{2}{3}$$

$$\text{JD}(e, f) = 1 - 0 = 1$$

$$\text{JD}(e, h) = 1 - 0 = 1$$

$$\text{JD}(f, h) = 1 - \emptyset = 1$$

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Powered by Quad Camera

$$\textcircled{2} \quad A \begin{pmatrix} 1 & 0 & 1 \\ 0 & 1 & 2 \\ 2 & 2 & 1 \end{pmatrix}$$

$$B \begin{pmatrix} 1 & 1 & 0 \\ 0 & 1 & 6 \\ 6 & 6 & 1 \end{pmatrix}$$

$$C \begin{pmatrix} 0 & 1 & 0 \\ 1 & 0 & 1 \\ 0 & 1 & 2 \end{pmatrix}$$

$$\cos(A, B) = \frac{1+1+12\alpha^2}{\sqrt{3+4\alpha^2} \sqrt{3+36\alpha^2}} \quad \left[ \frac{a \cdot b}{\sqrt{a^2} \cdot \sqrt{b^2}} \right]$$

$$= \frac{2+12\alpha^2}{\sqrt{9+12\alpha^2 + 144\alpha^4}}$$

$$\cos(B, C) = \frac{1+12\alpha^2}{\sqrt{3+36\alpha^2} \sqrt{2+4\alpha^2}} = \frac{4\alpha^2}{\sqrt{6+20\alpha^2 + 16\alpha^4}}$$

$$\cos(C, A) = \frac{4\alpha^2}{\sqrt{2+4\alpha^2} \sqrt{3+4\alpha^2}} = \frac{4\alpha^2}{\sqrt{6+20\alpha^2 + 16\alpha^4}}$$

$$\alpha = 0 \Rightarrow \cos(A, B) = 0.66, \cos(B, C) = 0.408$$

$$\cos(C, A) = 0$$

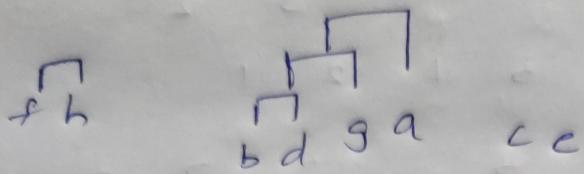
$$\alpha = 0.5 \Rightarrow \cos(A, B) = 0.716, \cos(B, C) = 0.666$$

$$\cos(C, A) = 0.28868$$

$$\alpha = 1 \Rightarrow \cos(A, B) = 0.8473, \cos(B, C) = 0.8498, \\ \cos(C, A) = 0.6172$$

$$\alpha = 2 \Rightarrow \cos(A, B) = 0.9461, \cos(B, C) = 0.9926 \\ \cos(C, A) = 0.8652$$

clustering the items hierarchically



∴ The final clusters are {f, h}, {b, d, g, a}, {c}, {e}.

$$④ H = \begin{vmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{vmatrix}$$

$$\begin{bmatrix} 5x \\ 5y \\ 5z \end{bmatrix} [5 \ 5 \ 5] = \begin{bmatrix} 5x & 5x & 5x \\ 5y & 5y & 5y \\ 5z & 5z & 5z \end{bmatrix} \rightarrow \emptyset$$

$$(5x-1)^2 + (5x-2)^2 + (5x-3)^2 + (5y-4)^2 + (5y-5)^2 + \\ (5z-6)^2 + (5z-7)^2 + (5z-8)^2 + (5z-9)^2 \rightarrow ③$$

Differentiate eq ③ with  $x$ ,

$$150x - 60 = 0 \Rightarrow x = 2/5$$

Differentiate eq ③ with  $y$ ,

$$150y - 150 = 0 \Rightarrow y = 1$$

Differentiate eq ③ with  $z$

$$150z - 240 = 0 \Rightarrow z = 8/5$$