Comsats University Isl.

Attock Campus

Course: CV

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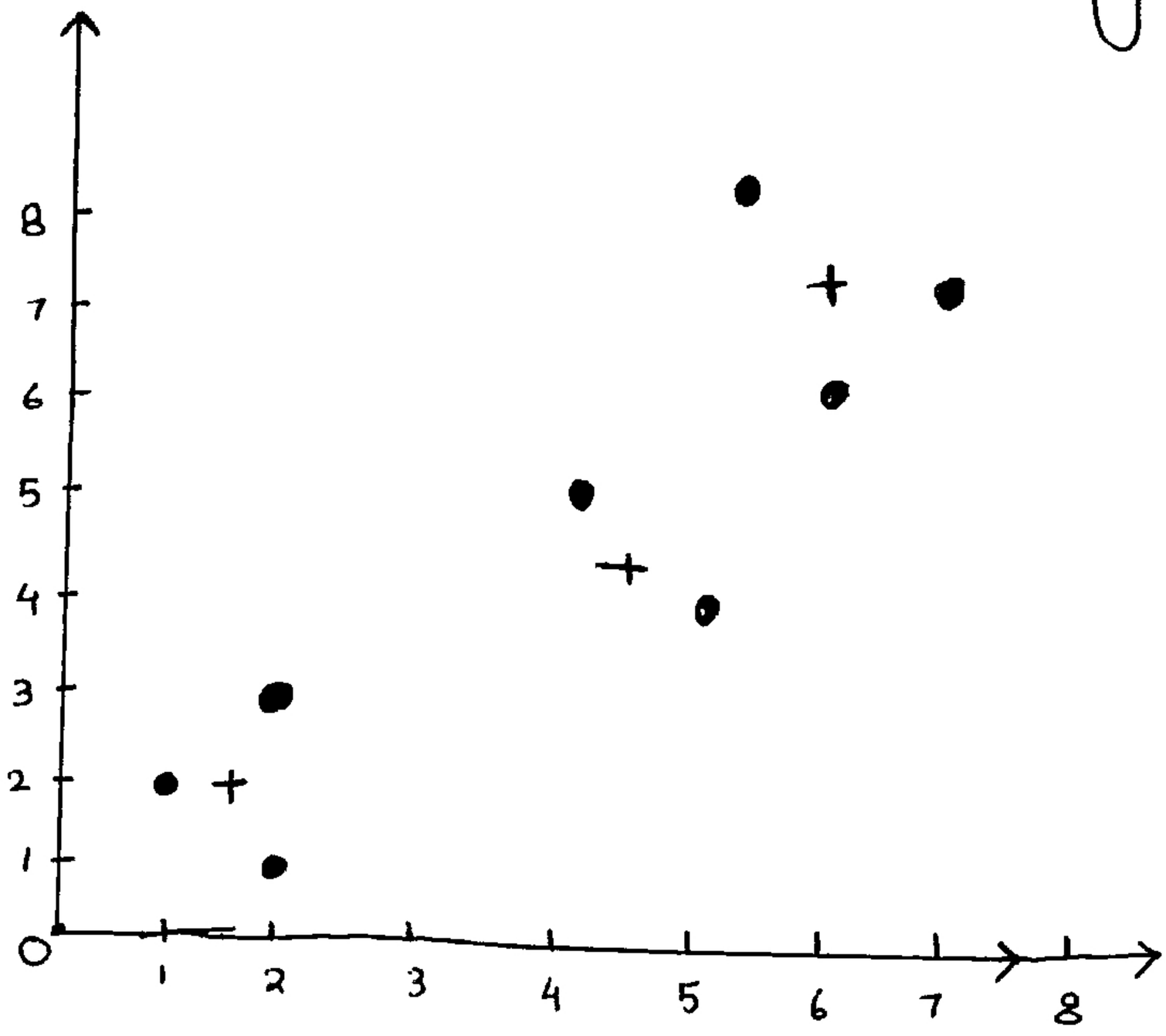
K-Mean Clustering-

Points:

1) $P_1 = (2, 1)$
2) $P_2 = (1, 2)$
3) $P_3 = (2, 3)$
4) $P_4 = (5, 4)$
5) $P_5 = (4, 5)$
6) $P_6 = (6, 6)$
7) $P_7 = (7, 7)$
8) $P_8 = (5, 8)$



* We should find the ~~the~~ number of K (clusters) by Elbow method but suppose **K is = 3**

* The centroids are randomly initialize So,

$C_1 = (1.5, 2)$

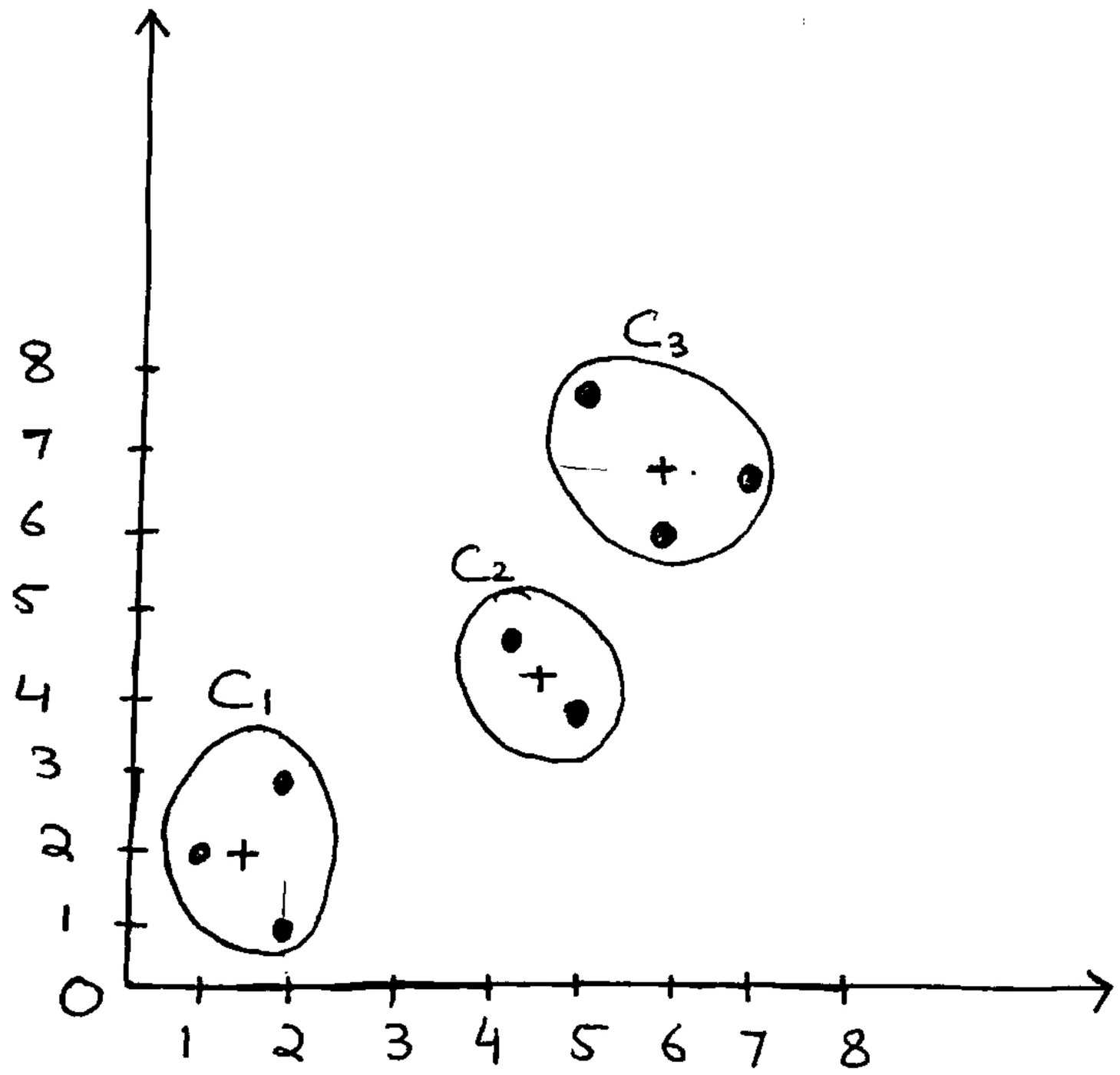
$C_2 = (4.5, 4.5)$

$C_3 = (6, 7)$

Now we will calculate the distance b/w centroids & the points so we can decide which point belongs to which cluster.

C_1	C_2	C_3
1) $d = \sqrt{(x_2-x_1)^2 + (y_2-y_1)^2}$ $= \sqrt{(2-1.5)^2 + (2-2)^2}$ $= \sqrt{1.25}$ P_1 belongs to C_1	$d = \sqrt{(x_2-x_1)^2 + (y_2-y_1)^2}$ $= \sqrt{(4.5-4.5)^2 + (1-4.5)^2}$ $= \sqrt{18.5}$	$d = \sqrt{(2-6)^2 + (1-7)^2}$ $= \sqrt{16+36}$ $\sqrt{52}$
2) $d = \sqrt{(1-1.5)^2 + (2-2)^2}$ $\sqrt{0.25}$ P_2 belongs to C_1	$d = \sqrt{(1-4.5)^2 + (2-4.5)^2}$ $\sqrt{18.5}$	$d = \sqrt{(1-6)^2 + (2-7)^2}$ $\sqrt{50}$
3) $d = \sqrt{(2-1.5)^2 + (3-2)^2}$ $\sqrt{1.25}$ P_3 belongs to C_1	$d = \sqrt{(2-4.5)^2 + (3-4.5)^2}$ $\sqrt{8.5}$	$d = \sqrt{(2-6)^2 + (3-7)^2}$ $\sqrt{32}$
4) $d = \sqrt{(5-1.5)^2 + (4-2)^2}$ $= \sqrt{16.25}$	$d = \sqrt{(5-4.5)^2 + (4-4.5)^2}$ $\sqrt{0.5}$ P_4 belongs to C_2	$d = \sqrt{(5-6)^2 + (4-7)^2}$ $\sqrt{10}$
5) $d = \sqrt{(4-1.5)^2 + (5-2)^2}$ $\sqrt{10.25}$	$d = \sqrt{(4-4.5)^2 + (5-4.5)^2}$ $\sqrt{0.5}$ P_5 belong to C_2 ..	$d = \sqrt{(4-6)^2 + (5-7)^2}$ $\sqrt{8}$

	C_1	C_2	C_3
6)	$\sqrt{(6-1.5)^2+(6-2)^2}$ $\sqrt{36.25}$	$\sqrt{(6-4.5)^2+(6-4.5)^2}$ $\sqrt{4.5}$	$\sqrt{(6-6)^2+(6-7)^2}$ $\sqrt{1}$ P_6 belongs to C_3
7)	$\sqrt{(7-1.5)^2+(7-2)^2}$ $\sqrt{55.25}$	$\sqrt{(7-4.5)^2-(7-4.5)^2}$ $\sqrt{12.5}$	$\sqrt{(7-6)^2+(7-7)^2}$ $\sqrt{1}$ P_7 belongs to C_3
8)	$\sqrt{(5-1.5)^2+(8-2)^2}$ $\sqrt{48.25}$	$\sqrt{(5-4.5)^2+(8-4.5)^2}$ $\sqrt{12.5}$	$\sqrt{(5-6)^2+(8-7)^2}$ $\sqrt{2}$ P_8 belongs to C_3



★ Now we will calculate the New Values for centroids. To get new values for centroids we will add the value of that x-coordinate of all the point in cluster and same for y-coordinate and then divide it by total number of points in that cluster

$$C_1 = \left(\frac{x\text{-}P_1 + x\text{-}P_2 + x\text{-}P_3}{3}, \frac{y\text{-}P_1 + yP_2 + yP_3}{3}\right)$$

$$C_1 = \left(\frac{2 + 1 + 2}{3}, \frac{1 + 2 + 3}{3}\right) \Rightarrow \left(\frac{5}{3}, \frac{6}{3}\right)$$

$$\boxed{C_1 = (1.6, 2)}$$

$$C_2 = \left(\frac{5+4}{2}, \frac{4+5}{2}\right) \Rightarrow \left(\frac{9}{2}, \frac{9}{2}\right)$$

$$\boxed{C_2 = (4.5, 4.5)}$$

$$C_3 = \left(\frac{6+7+5}{3}, \frac{6+7+8}{3}\right) \Rightarrow \left(\frac{18}{3}, \frac{21}{3}\right)$$

$$\boxed{C_3 = (6, 7)}$$

So the centroids are as following

$C_1 = (1.6, 2)$

$C_2 = (4.5, 4.5)$

$C_3 = (6, 7)$

★ Again Calculate the distance for every Point with every centroid.

	C_1	C_2	C_3
1)	$d = \sqrt{(2-1.6)^2 + (1-2)^2}$	$\sqrt{18.5}$	$\sqrt{52}$
	$\sqrt{0.33}$		
	P_1 belongs to C_1		
2)	$d = \sqrt{(1-1.6)^2 + (2-2)^2}$	$\sqrt{18-5}$	$\sqrt{50}$
	$= 1.86$		
	P_2 belongs to C_1		
3)	$d = \sqrt{(2-1.6)^2 + (3-2)^2}$	$\sqrt{8.5}$	$\sqrt{32}$
	1.86		
	P_3 belongs to C_1		
4)	6.72	$\sqrt{0.5}$	$\sqrt{10}$
		P_4 belongs to C_2	
5)	8.38	$\sqrt{0.5}$	$\sqrt{8}$
		P_5 belongs to C_2	
6)	6.51	$\sqrt{4.5}$	$\sqrt{1}$
			P_6 belongs to C_3
7)	8.38	$\sqrt{12.5}$	$\sqrt{1}$
			P_7 belongs to C_3
8)	7.59	$\sqrt{12.5}$	$\sqrt{2}$
			P_8 belongs to C_3

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