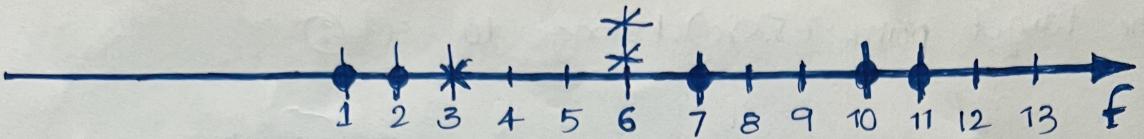


Q10) Ans: Differentiating the points by (x, y) co-ordinates.



Dividing the given data into two parts:

Set 1: point at $2(2, 0)$ Set 2: point at $1(1, 0)$

point at $6(7, 0)$

point at $6(6, 0)$

point at $11(11, 0)$

point at $10(10, 0)$

point at $3(3, 0)$

point at $6(6, 0.5)$

Training set

Testing Set

\Rightarrow Consider a point, we say $(5.5, 0)$ is the point to be classified.

KNN classifier:

$$\text{Point } (X_1, Y_1) = (5.5, 0)$$

Using Euclidean distance

$$= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

For point $(2, 0)$ and $(5.5, 0)$

$$x_1, y_1 \quad x_2, y_2$$

$$\begin{aligned} d_{20} &= \sqrt{(5.5 - 2)^2 + (0 - 0)^2} \\ &= \sqrt{(3.5)^2 + (0)^2} \\ &= \sqrt{(3.5)^2} = \sqrt{3.5} \end{aligned}$$

For training set

X	2	7	11	3
Y	0	0	0	0
distance	3.5	2.0	5.5	6.25

For the testing set:

X	1	6	10	6
Y	0	0	0	0.5
distance	4.5	0.25	4.5	0.5

IN KNN, for $k=3$:

Consider Three Nearest points for $(5.5, 0)$

3 Nearest points.

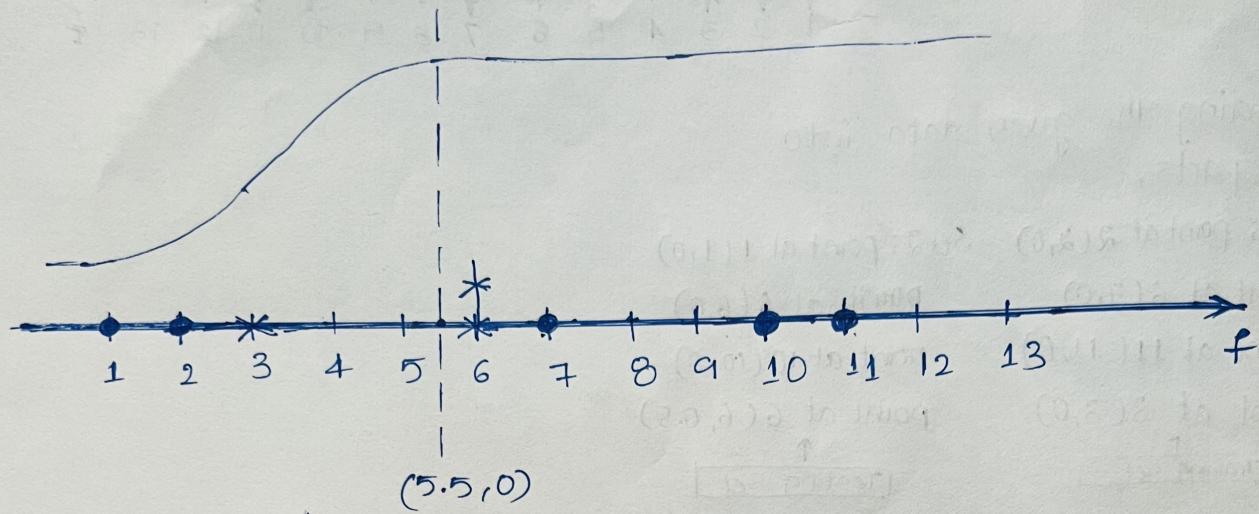
① $(6, 0)$, ② $(6, 0.5)$ ③ $(7, 0)$

$(6, 0)$ \rightarrow set ②

$(6, 0.5)$

$(7, 0)$ \rightarrow set ①

Majority of the points belongs to set ②,
so, the target point $(5.5, 0)$ belongs to set ②



Consider the points (x) on the left side of the dotted line are correctly classified, and on the right side, the point (x) are wrongly classified.

80. 1 { The point $\bullet(1, 0)$ is wrongly classified
2 { Point $\bullet(2, 0)$ is wrongly classified

- 1 - Point $\times(3, 0)$ is correctly classified
2 { Point $\times(6, 0)$ is wrongly classified
2 { Point $\times(6, 0.5)$ is wrongly classified

- 3 { 3 points $\bullet(7, 0), (10, 0), (11, 0)$ are correctly classified.

Confusion Matrix:

		Prediction	
		0	1
Truth	0	1	2
	1	2	3

$$TN = 1 \quad FN = 2$$

$$TP = 3 \quad FP = 2$$

$$\text{Accuracy} : \frac{(TP+TN)}{P+N} = \frac{TP+TN}{(TP+FN)+(FP+TN)} \\ = \frac{3+1}{(3+2)+(2+1)} = \frac{4}{8} = 0.5$$

$$\text{Sensitivity} : \frac{TP}{P} = \frac{TP}{(TP+FN)} = \frac{3}{3+2} = \frac{3}{5} = 0.6$$

$$\text{Specificity} : \frac{TN}{N} = \frac{TN}{FP+TN} \\ = \frac{1}{2+1} = \frac{1}{3} \\ = 0.33$$

$$\text{Accuracy} = 0.5$$

$$\text{Sensitivity} = 1$$

$$\text{Specificity} = 0.33.$$