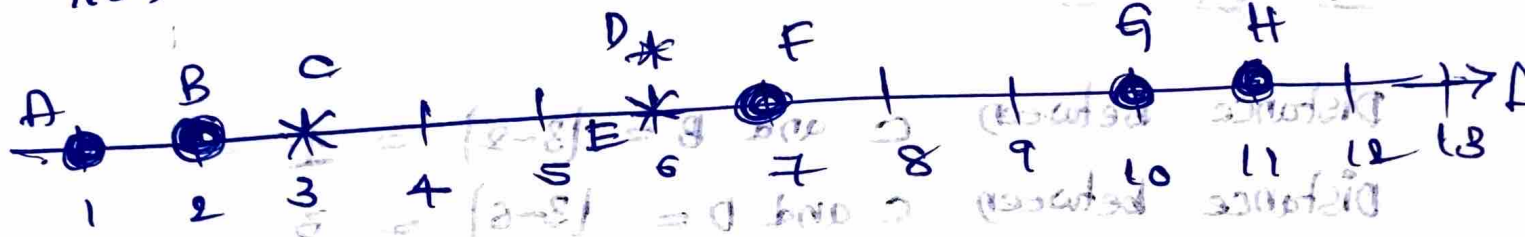
10)

Sol:

Given



(a)

Let us split the given data points into 2 equal sets; one set is for training and another one is for testing.

⇒ Training set: {B, D, F, H}

Testing set: {A, C, E, G}

Given K=3 i.e., we need to consider 3 nearest neighbours

(i) 'A' Data point :-

Distance between A and B = |1-2| = 1

Distance between A and D = |1-6| = 5

Distance between A and F = |1-7| = 6

Distance between A and H = |1-11| = 10

The 3 nearest neighbours for A is B, D, F with 1, 5, 6 respectively; in which B & F are of ● type and D is of * type

So, ultimately A will be ● type data point

(ii) 'C' Data point :-

Distance between C and B = $|3-2| = 1$

Distance between C and D = $|3-6| = 3$

Distance between C and E = $|3-7| = 4$

Distance between C and H = $|3-11| = 9$

The 3 nearest neighbours of C are B, D, F with 1, 3, 4 distances respectively ; In which B & F are circle type & D is ~~of~~ ~~X~~ type

So, C is also a circle type

(iii) 'E' Data point :-

Distance between E and B = $|6-2| = 4$

Distance between E and D = $|6-6| = 0$

Distance between E and F = $|6-7| = 1$

Distance between E and H = $|6-11| = 5$

Similarly, E is also a circle type because the 3 nearest neighbours of E are B, D, F In which the majority are circle type.

(iv) 'Q' data point:-

Distance between Q and B = $|10-2| = 8$

Distance between Q and D = $|10-6| = 4$

Distance between Q and F = $|10-7| = 3$

Distance between Q and H = $|10-11| = 1$

The 3 nearest neighbours of Q are D, F, H with 4, 3, 1 distances in which majority are circle type

So Q is also circle type.

b)

From the conclusions that we got from the above, we can classify the Actual & predicted types of the data points

Data points	A	B	C	D	E	F	G	H
Actual classification	●	●	X	X	X	●	●	●
Predicted classification	●	●	●	X	●	●	●	●
	TP	TP	FP	TN	FP	TP	TP	TP

Confusion Matrix:-

Truth \ Prediction	0	1
0	TN (1)	FP (2)
1	FN (0)	TP (5)

$$\text{Accuracy} = \frac{TP + TN}{P + N} = \frac{5+1}{5+3} = 0.75$$

$$\text{sensitivity} = \frac{TP}{TP + FN} = \frac{5}{5+0} = 1$$

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