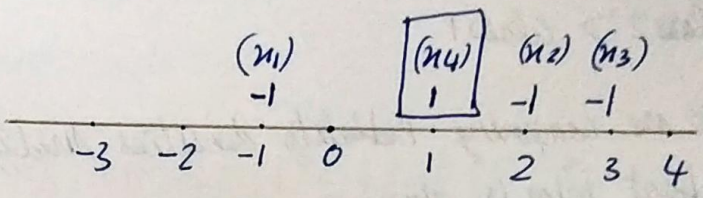
2.



No linear boundry can seperate label 1 and -1. [1D]

∴ not linearly seperable.

11.

$D_1 = -1, -2, 3, 3, 6, 7$

$D_2 = -3, -2, 3, 5, 8$

widow width $h = 2$

window function $\phi(u) = \begin{cases} -\frac{3}{4}u^2 + \frac{3}{4} & \text{if } -1 \le u \le 1 \\ 0 \end{cases}$

$x = 4$ (what class?)

$$P(x) = \frac{k/n}{V}$$

$V = h' = 2$

For class 1

$$P(x) = P(4) = \frac{1}{h} \sum_{i=1}^{i=n} \frac{1}{nd} \left[-\frac{3}{4}u^2 + \frac{3}{4}\right]$$

$$= \frac{1}{6} \sum_{i=1}^{6} \frac{1}{2} \left[-\frac{3}{4}u^2 + \frac{3}{4}\right]$$

$$= \frac{1}{12} \left[\left(-\frac{3}{4}(-1)^2 + \frac{3}{4}\right) + 0 + 0 + 0 + 0\right] = \frac{\phi(1/2)}{6} = \frac{9}{16 \times 6}$$

Class 2

$$\frac{1}{5}\sum_{i=1}^{5}\frac{1}{2}\phi\left(\frac{4-x_i}{2}\right) = \frac{1}{10}\left(\phi\left(\frac{1}{2}\right)+\phi\left(-\frac{1}{2}\right)+0+0+0\right)$$

$$= \frac{\phi\left(\frac{1}{2}\right)}{5} = \frac{9}{16\times 5} = 0.1125 \quad (\text{Class 2})$$

$$\text{Class 1} = 0.09375$$

Class 2 > Class 1

We are comparing Probability densities directly, as no information about prior is given.

13)

Using Single-link algorithm

+ This algorithm uses d_{min} as the similarity measure.
+ We will combine clusters that have high similarity measure.

From the matrix it can be seen. P_2 and P_3 have high similarity.

$$Sim(P_2, P_3) = 0.95$$

Step 1

$(P_1\ (P_2, P_3), P_4, P_5, P_6)$

Step 2

P_5 and P_6 have high similarity. $sim(P_5, P_6) = (0.85)$

$\{P_1\ \{P_2, P_3\}, P_4, \{P_5, P_6\}\}$

Step 3

$P_{(5,6)\to 4} = min(d_{5,4}, d_{6,4}) = max(similarity_{5,4}, similarity_{6,4})$

Comparing with all clusters P_4 is similar to P_5, P_6

$\{P_1, \{P_2, P_3\}, \{P_4, \{P_5, P_6\}\}\}$

$$Sim_{(5,6)\to 4} = max(0.80, 0.65) = 0.80$$

$$Sim_{(2,3)\to 4} = max(0.70, 0.75) = 0.75$$

Step 4

By comparing all clusters

Clusters $\{P_2, P_3\}$ and $\{P_4, \{P_5, P_6\}\}$ are more similar.

$\Rightarrow \{P_1, \{\{P_2, P_3\}, \{P_4, \{P_5, P_6\}\}\}$

Step 5

add the last cluster.

$= \{\{P_1\}, \{\{P_2, P_3\}, \{P_4, \{P_5, P_6\}\}\}\}$

The Dendrogram 'D' ort depicts the clusters.

14.

Complete linkage Algorithm.

+ In single linkage we took max (similarity $_{cluster_1}$, similarity $_{cluster_2}$)
+ Here we will find highest (farthest) neighbour between clusters unlike in single linkage.

Step 1

Clusters P_2 and P_3 are more similar.

$= \{P_1, \{P_2, P_3\}, P_4, P_5, P_6\}$ $\quad sim(P_2, P_3) = 0.95$

Step 2

Cluster P_5 and P_6 has the highest similarity

$= \{P_1, \{P_2, P_3\}, P_4, \{P_5, P_6\}\}$ $\quad sim(P_5, P_6) = 0.85$

Step 3

we compare all clusters with all clusters the difference here is we compare with farthest neighbours.

$d_{5,6 \to 4} = \min(0.80, 0.65) = 0.65$

$d_{2,3 \to 4} = \min(0.70, 0.75) = 0.75$

hence cluster 4 is similar ~~to~~ cluster 2,3

$\Rightarrow \{1, \{\{2,3\}, 4\}, \{5,6\}\}$

Step 4

like in step 3 we compare all, cluster 1 is similar to cluster {2,3,4} than {5,6}

$= \{\{1, \{\{2,3\}, 4\}\}, \{5,6\}\}$

Step 5

Add all cluster together (the last cluster)

$= \{\{1, \{\{2,3\}, 4\}\}, \{5,6\}\}$

∴ The dendrogram 'B' is correct for multilinkage Algorithm.