PR: MIDTERM

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2024OAI1002

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name: ABHISHEK JANGID

Given

Q1) $X = 2, 4, 6, 8$

$y = 8, 9, 10, 12$

$\mu_x = 5$

$\mu_y = 10$

$$\boxed{Cov(X,Y) = \frac{1}{n} \sum (x-\mu_x)(y-\mu_y)}$$

~~Cov(2,8)~~

x	y	$(x-\mu_x) \cdot (y-\mu_y)$	
2	8	$(2-5) \cdot (8-10)$	= 6
4	9	$(4-5) \cdot (9-10)$	= 1
6	10	$(6-5) \cdot (11-10)$	= 1
8	12	$(8-5) \cdot (12-10)$	= 6

$Cov(X,Y) = \frac{1}{4} \times (6+1+1+6)$

$$\boxed{Cov(X,Y) = \frac{1}{4} \times 14 = 3.5}$$

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b) variance tells how spreadout the data points around its mean.

High variance.

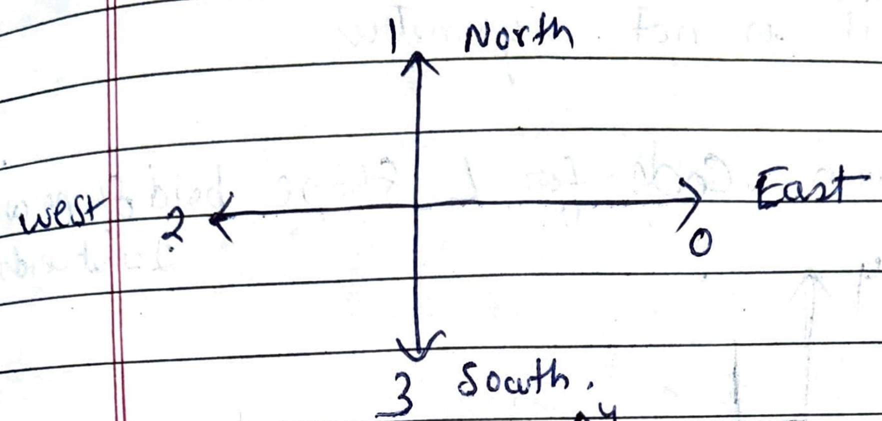
→ when variance of class is high. data points are more speadout around its mean, result in more complex decision boundry

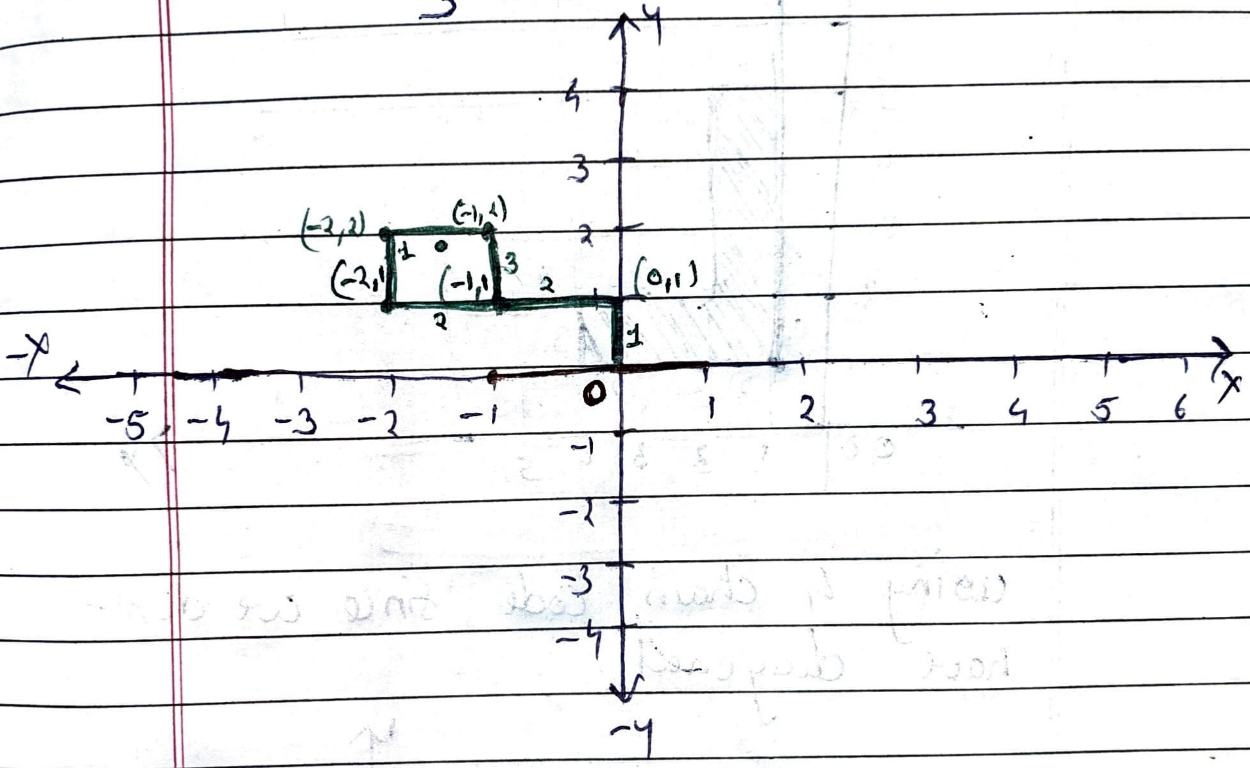
Low variance

when variance of class is low data points are clustered around its mean result in clear and simple decision boundry

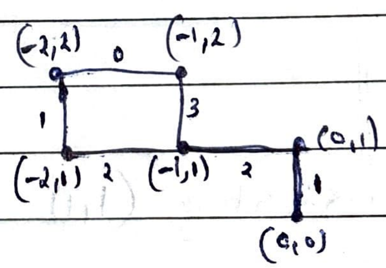
Q2 a) Chain Code [1, 2, 2, 1, 0, 3]

4 directional chain code





1	↑	(0, 1)
2	←	(-1, 1)
2	←	(-2, 1)
1	↑	(-2, 2)
0	→	(-1, 2)
3	↓	(-1, 1)



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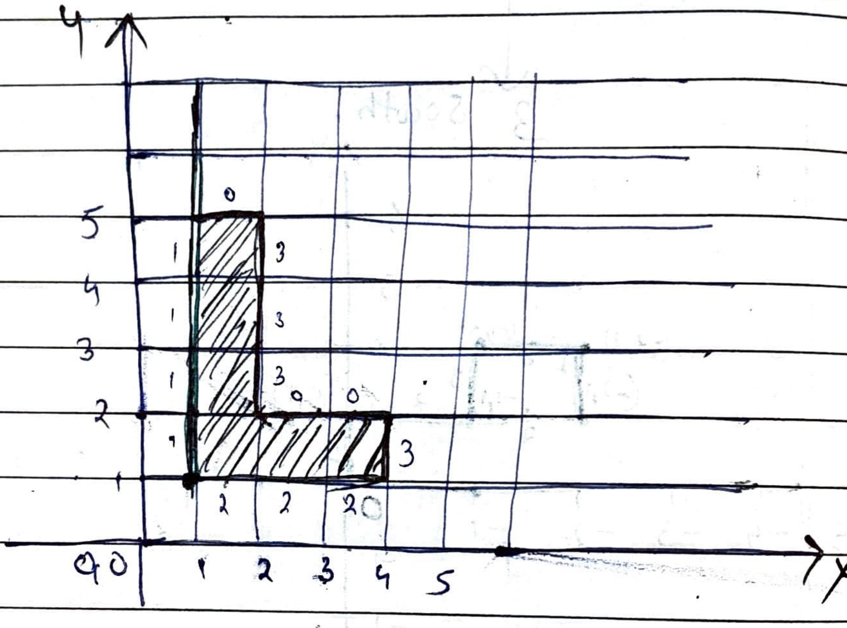
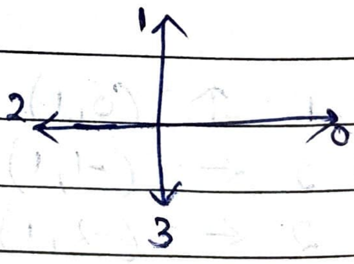
→ Shape is not closed like rectangle, square.
→ It has more vertical width.
→ it is not symmetric

Q2) b) chain Code for L shape bold shape with 1 unit width.



using 4 chain code since we don't have diagonal.



Starting (1,1)

Chain Code [1, 1, 1, 1, 0, 3, 3, 3, 0, 0, 3, 2, 2, 2]

$\boxed{[1, 1, 1, 1, 0, 3, 3, 3, 0, 0, 3, 2, 2, 2]}$

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Q3 $P(C_1) = 0.6$

$P(C_2) = 0.4$

$P(F|C_1) = 0.85$

$P(F|C_2) = 0.15$

Compute $P(C_1|F)$ $P(C_2|F)$

Sln

$$\boxed{P(C_1|F) = \frac{P(F|C_1) * P(C_1)}{P(F)}}$$

$$P(F) = P(F|C_1) * P(C_1) + P(F|C_2) * P(C_2)$$

$$= (0.85 * 0.6) + (0.15 * 0.4)$$

$$= 0.57$$

$$\therefore P(C_1|F) = \frac{0.85 * 0.6}{0.57}$$

$$\boxed{P(C_1|F) = 0.894}$$

$$P(C_2|F) = \frac{P(F|C_2)\ P(C_2)}{P(F)}$$

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$$= \frac{0.15 * 0.4}{0.57}$$

$$\boxed{P(C_2|F) = 0.105}$$

(b) Given

$P(F|C_1) = 0.85 - 0.1 = 0.75$

$P(F|C_2) = 0.15 + 0.1 = 0.25$

$$\boxed{0.75 + 0.25 = 1}$$

$P(F) = P(F|C_1) P(C_1) + P(F|C_2) * P(C_2)$

$= (0.75 * 0.6) + (0.25 \times 0.4)$

$P(F) = 0.55$

$P(C_1|F) = \frac{P(F|C_1) * P(C_1)}{P(F)}$

$= \frac{0.75 \times 0.6}{0.55}$

$$\boxed{P(C_1|F) = 0.8182}$$

$P(C_2|F) = \frac{P(F|C_2) * P(C_2)}{P(F)}$

$= \frac{0.25 \times 0.4}{0.55}$

$$\boxed{P(C_2|F) = 0.1818}$$

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Q4)

$P(C_1) = 0.75$
$P(C_2) = 0.25$

Error Cost $(C_1 \rightarrow C_2) = 3$
error Cost $(C_2 \rightarrow C_1) = 1$

Expected Loss $= P(C_1) * \text{Error}(C_1) +$
$P(C_2) * \text{Error}(C_2)$

$= \cancel{RC}\ 0.75 \times 1 + 0.25 * 3$

$= 0.75 + 0.75$

$$\boxed{\text{Expected Loss} = 1.5}$$