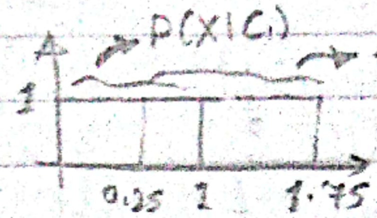
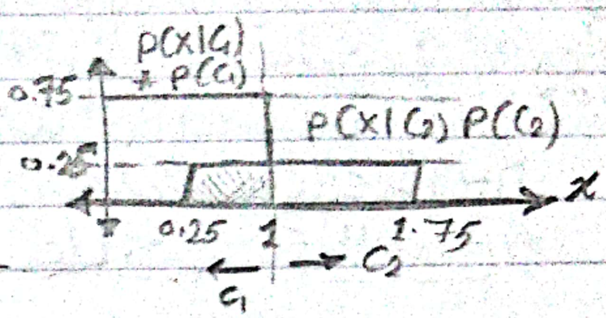
Sh 3 Bayes "Gaussian"

Q1 $P(C_1) = 0.75$
$P(C_2) = 0.25$



$$P(error) = \int_{-\infty}^{1} P(x|C_2)P(C_2)\,dx + \int_{1}^{\infty} P(x|C_1)P(C_1)\,dx$$

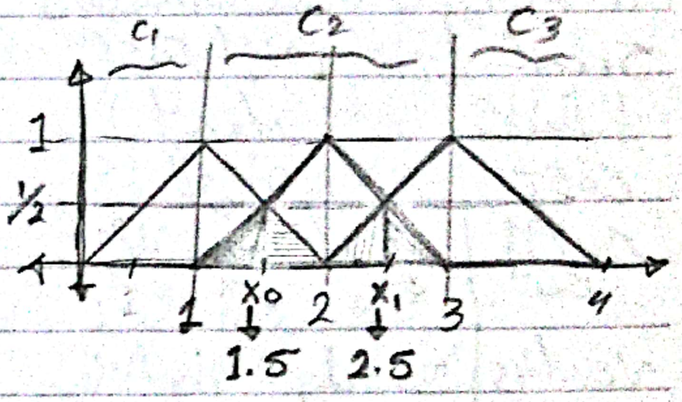


$= \text{Area}[\ \ ]$
$= 0.25 * 0.25$
$= 1/16$

$$P(correct) = 1 - 1/16 = \frac{15}{16}$$

دول كان Given وجبنا منه
التاني ، ال DB عند x=1
اللى هو مكان ما ال max اتغير

Q2 $P(C_1) = P(C_2) = P(C_3) = 1/3$



$P(x|C_1)P(C_1) = P(x|C_2)P(C_2)$

$2 - x = x - 1$

$2x = 3$

$\boxed{x_0 = 1.5}$ or بالنظر

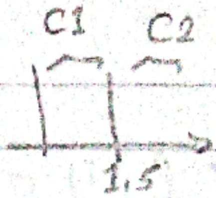
$\in C_1$ if $x \le 1.5$
$x \in C_2$ if $1.5 < x \le 2.5$
$\in C_3$ if $x > 2.5$

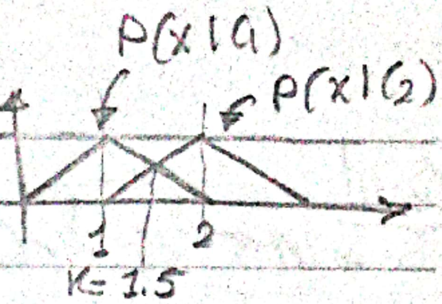
$$P(error) = \int_{1.5}^{\cancel{\infty}\ 2} P(x|C_1)P(C_1)\,dx + \int_{\cancel{-\infty}\ 1}^{1.5} P(x|C_2)P(C_2)\,dx + \int_{2.5}^{\cancel{\infty}\ 3} P(x|C_2)P(C_2)\,dx$$

$$+ \int_{\cancel{-\infty}\ 2}^{2.5} P(x|C_3)P(C_3)\,dx$$

$$= 4 * [1/2 * 1/2 * 1/2] * 1/3 = \frac{1}{6}$$

$\boxed{Q:3}$ $P(C_1) = P(C_2) = \frac{1}{2}$



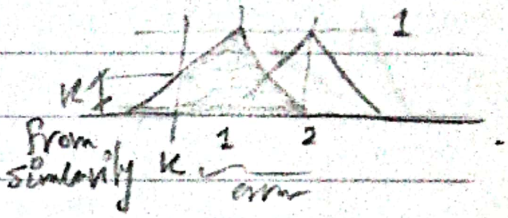


Show that any other class. Rule Results in a higher P(error)

يعني لو K بأي ما جه غير 1.5 ، ال P(error) هتزيد !

Case 1 let $K \leq 1$

$$P(error) = \left[\tfrac{1}{2} \times 2 \times 1 + \tfrac{1}{2} K \times K\right] \times P(C)$$
$$= \tfrac{1}{2}\left[1 + \frac{K^2}{2}\right]$$

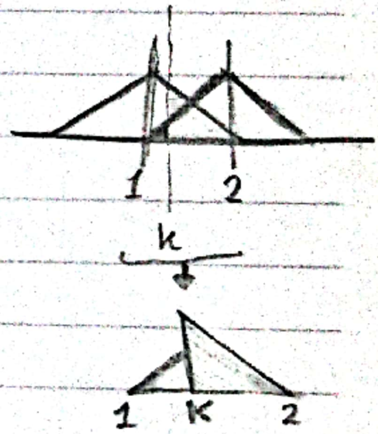


$K \to 0 \longrightarrow P(e) = \frac{1}{2}$

$K \to 1 \longrightarrow P(e) = \frac{1}{4}$

Case 2 Let $K \geq 2 \longrightarrow$ Same as **Case 1**

Case 3 $1 \leq K \leq 2$



$$p(e) = \int_1^K P(x|C_2)\,P(C_2)\,dx + \int_K^2 P(x|C_1)\,P(C_1)\,dx$$

$$= \frac{(K-1)^2}{2} \times \frac{1}{2} + \frac{(2-K)^2}{2} \times \frac{1}{2}$$

P(C2)   P(C1)

$$= \frac{1}{4}\left((K-1)^2 + (2-K)^2\right)$$

$$\frac{dP(e)}{dK} = 0 \Rightarrow 2(K-1) = 2(2-K) \Rightarrow 2K = 3$$

$$\boxed{K = 1.5}$$

So the min value of $P(e)$ is at $\boxed{K = 1.5}$

$$P(e)_{K=1.5} = \frac{1}{8}$$

$\boxed{Q:4}$

* As μ_1 & μ_2 get further → $P(e)\downarrow$ 

* As σ_1 & σ_2 increases → $P(e)\uparrow$ 

* As $P(C_1)$ & $P(C_2)$ approaches 0.5 → $P(e)\uparrow$