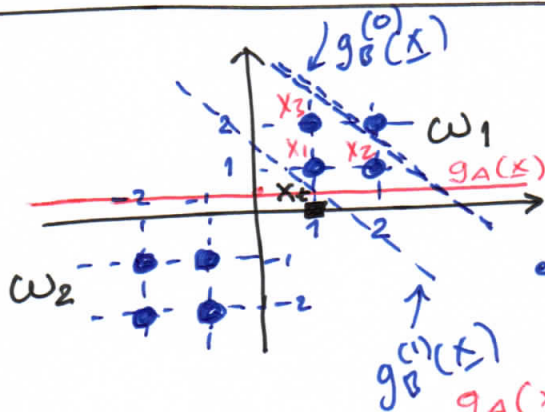


1a



• Προφανώς είναι διαχωρίσιτες γραμμικά!

• Η ευθεία $x_2 = 0.5$ πετυχαίνει το 7η καλύτερο

$$g_A(x) = 0x_1 + 1x_2 - \frac{1}{2} \Leftrightarrow \underline{\omega} = \begin{bmatrix} 0 \\ 1 \\ -1/2 \end{bmatrix}$$

$$g_A(x) > 0, \forall x \in \omega_1$$

$$g_A(x) < 0, \forall x \in \omega_2$$

1b

$$w(0) = \begin{bmatrix} 1 \\ 1 \\ -15/4 \end{bmatrix} \Leftrightarrow g_B^{(0)}(x) = x_1 + x_2 - \frac{15}{4}$$

$g_B^{(0)}(1,1), g_B^{(0)}(1,2), g_B^{(0)}(2,2) < 0$ NOT OK
 $g_B^{(0)}(2,2) > 0$ OK, ω_2 όλα τα OK ($g_B^{(0)}(x) < 0$)

Απλ: $w(1) = w(0) + \rho(x_1 + x_2 + x_3) =$
 $= \begin{bmatrix} 1 \\ 1 \\ -15/4 \end{bmatrix} + \frac{1}{4} \left(\begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix} + \begin{bmatrix} 2 \\ 1 \\ 1 \end{bmatrix} + \begin{bmatrix} 1 \\ 2 \\ 1 \end{bmatrix} \right) = \begin{bmatrix} 2 \\ 2 \\ -3 \end{bmatrix}$

$$\Rightarrow g_B^{(1)}(x) = \boxed{2x_1 + 2x_2 - 3}$$

\downarrow όλα τα $\omega_1 \rightarrow > 0$
 \downarrow όλα τα $\omega_2 \rightarrow < 0$ } OK!

$x_{test}: g_B^{(1)}(x_{test}) = 2 - 3 < 0$
 $\downarrow \rightarrow \in \omega_2$

19

$$\hat{\mu}_1 = \frac{1}{4} \sum_{i=1}^4 \underline{x}_i = \frac{1}{4} \begin{pmatrix} 1+2+1+2 \\ 1+1+2+2 \end{pmatrix} = \begin{bmatrix} 3/2 \\ 3/2 \end{bmatrix}$$

$$\hat{\mu}_2 = \frac{1}{4} \sum_{i=5}^8 \underline{x}_i = \begin{bmatrix} -3/2 \\ -3/2 \end{bmatrix}$$

$$\hat{\Sigma}_1 = \frac{1}{3} \begin{bmatrix} -1/2 & -1/2 & +1/2 & +1/2 \\ -1/2 & +1/2 & -1/2 & +1/2 \end{bmatrix} \begin{bmatrix} \\ \\ \\ \end{bmatrix} = \frac{1}{3} \frac{1}{4} \begin{bmatrix} 4 & 0 \\ 0 & 4 \end{bmatrix} = \frac{1}{3} \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

$$\frac{1}{\sqrt{|\Sigma_1|}} = \frac{1}{\sqrt{1/9}}$$

$$|\Sigma_1| = 1/9$$

$$P(\underline{x} | \omega_1) = \frac{1}{2\pi} \cdot 3 \exp\left(-\frac{1}{2} \left(\underline{x} - \begin{bmatrix} 3/2 \\ 3/2 \end{bmatrix}\right)^T \begin{bmatrix} 3 & 0 \\ 0 & 3 \end{bmatrix} \left(\underline{x} - \begin{bmatrix} 3/2 \\ 3/2 \end{bmatrix}\right)\right)$$

$$P(\underline{x} | \omega_2) = \frac{1}{2\pi} \cdot 3 \exp\left(-\frac{1}{2} \left(\underline{x} + \begin{bmatrix} 3/2 \\ 3/2 \end{bmatrix}\right)^T \begin{bmatrix} 3 & 0 \\ 0 & 3 \end{bmatrix} \left(\underline{x} + \begin{bmatrix} 3/2 \\ 3/2 \end{bmatrix}\right)\right)$$

$$P(\omega_1) = P(\omega_2) = 1/2$$

$$X_{\text{test}} \in \omega_1$$

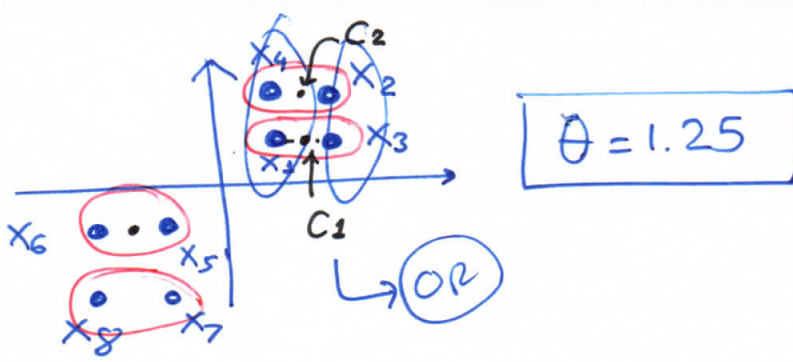
Επιφάνεια διαχωρισμού:

$$X_1 + X_2 = 0$$

$$\hat{\mu}_1 - \hat{\mu}_2 = \begin{bmatrix} 3/2 + 3/2 \\ 3/2 + 3/2 \end{bmatrix} = \begin{bmatrix} 3 \\ 3 \end{bmatrix}$$

$$\leadsto 3X_1 + 3X_2 = 0$$

2a



STEP 1: $\{x_1\}$

STEP 2: $\{x_1\} \{x_2\}$
 $\xrightarrow{d=2}$

STEP 3: $\{x_1, x_3\}, \{x_2\}$
 $\hookrightarrow C_1$

STEP 4: $\{x_1, x_3\}, \{x_2, x_4\}$
 $\hookrightarrow C_1 \quad \hookrightarrow C_2$

ΙΣΟΔΥΝΑΜΑ
 $\{x_1, x_4\}, \{x_2, x_3\}$

STEP 5: $\{x_1, x_3\}, \{x_2, x_4\}, \{x_5\}$

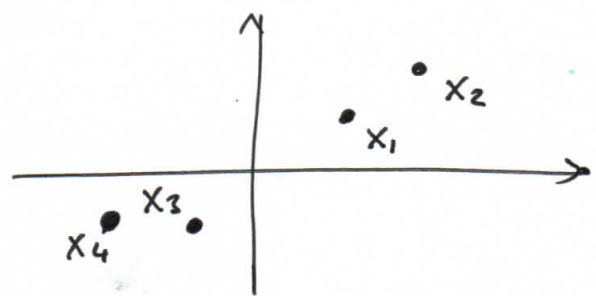
STEP 6: $\{x_1, x_3\}, \{x_2, x_4\}, \{x_5, x_6\}$
 $\hookrightarrow C_3$

$\{x_7\}$

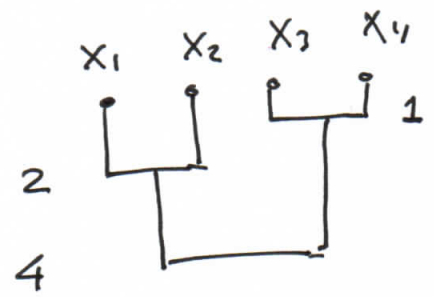
STEP 7:

STEP 8: $\{x_1, x_3\}, \{x_2, x_4\}, \{x_5, x_6\}, \{x_7, x_8\}$
 $\{x_1, x_4\}, \text{OR} \{x_2, x_3\}, \{x_5, x_6\}, \{x_7, x_8\}$

2b



	x_1	x_2	x_3	x_4
x_1	0	2	4	5
x_2	2	0	6	7
x_3	4	6	0	1
x_4	5	7	1	0



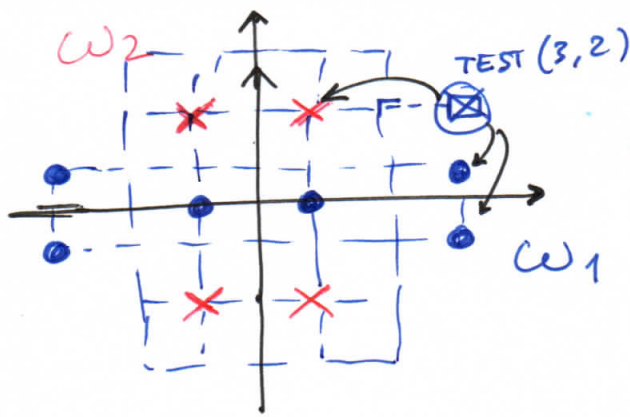
$\{x_3, x_4\}$

	x_1	x_2	$\{x_3, x_4\}$
x_1	0	2	4
x_2	2	0	6
$\{x_3, x_4\}$	4	6	0

$\{x_1, x_2\}$

	$\{x_1, x_2\}$	$\{x_3, x_4\}$
$\{x_1, x_2\}$	0	4
$\{x_3, x_4\}$	4	0

3A



• ΟΧΙ, ΔΕΝ ΕΙΝΑΙ

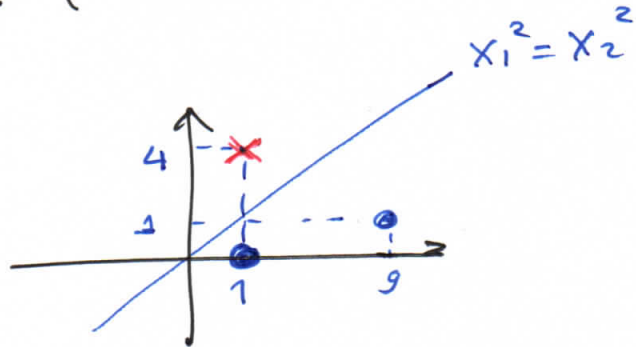
3B

ΚΛΑΣΗ ω_1 (2 ΣΤΑ 3)

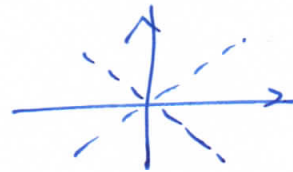
3C

$$y_1 = x_1^2$$

$$y_2 = x_2^2$$



Ισοδύναμα $x_1 = \pm x_2$



ΕΝΑΛΛΑΚΤΙΚΑ

$$x_2^2 = 2 \iff x_2 = \pm \sqrt{2}$$

... ΚΤΛ ...