1. 类 w_1 : $(1,4,1)^T$ $(2,3,1)^T$

类 w_2 : $(4,1,1)^T$ $(3,2,1)^T$ $\Rightarrow$ $(-4,-1,-1)^T$ $(-3,-2,-1)^T$

$J_p(a) = \sum_{y\in Y} (-a^T y)$, $a_0 = (0,1,0)^T$

$\frac{\partial J_p(a)}{\partial a} = -\sum_{y\in Y} y$

$a_1 = a_0 + \sum y = (0,1,0)^T + (-4,-1,-1)^T + (-3,-2,-1)^T$

$= (-7,-2,-2)^T$

$a_2 = a_1 + \sum y = (-7,-2,-2)^T + (1,4,1)^T + (2,3,1)^T$

$= (-4,5,0)^T$

满足 $a^T y_i > 0$

$\therefore a = (-4,5,0)^T$

2. ① $\begin{cases} g_1(x) > g_2(x) \\ g_1(x) > g_3(x) \end{cases}$ $\begin{cases} -x_1 + x_2 > x_1 + x_2 - 1 \\ -x_1 + x_2 > -x_2 \end{cases}$

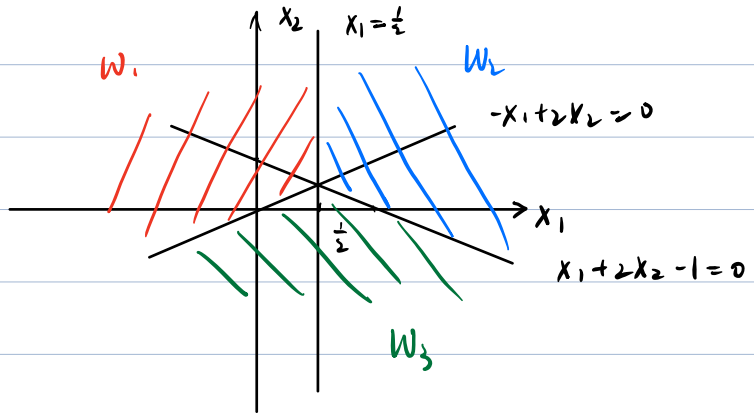
$\Downarrow$ $\begin{cases} x_1 < \frac{1}{2} \\ -x_1 + 2x_2 > 0 \end{cases}$

② $\begin{cases} g_2(x) > g_1(x) \\ g_2(x) > g_3(x) \end{cases}$ $\begin{cases} x_1 + x_2 - 1 > -x_1 + x_2 \\ x_1 + x_2 - 1 > -x_2 \end{cases}$

$\Downarrow$ $\begin{cases} x_1 > \frac{1}{2} \\ x_1 + 2x_2 - 1 > 0 \end{cases}$

③ $\begin{cases} g_3(x) > g_1(x) \\ g_3(x) > g_2(x) \end{cases}$ $\begin{cases} -x_2 > -x_1 + x_2 \\ -x_2 > x_1 + x_2 - 1 \end{cases}$

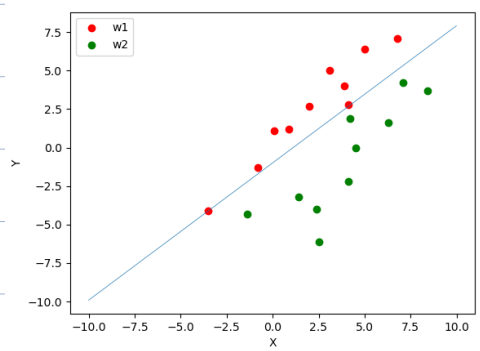
$\Downarrow$ $\begin{cases} -x_1 + 2x_2 < 0 \\ x_1 + 2x_2 - 1 < 0 \end{cases}$



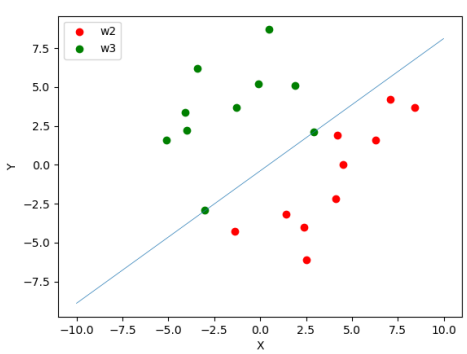
三个决策面交于 $(\frac{1}{2}, \frac{1}{2})$，不存在不确定区域

计算机编程

1. (a) 收敛步数：24　　$a=(-0.0304,\ 0.0341,\ 0.034)^T$

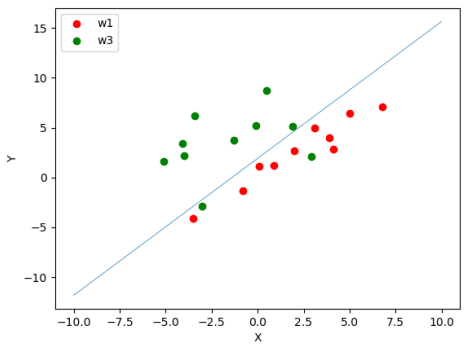


(b) 收敛步数：17　　$a=(0.0414,\ -0.0486,\ -0.019)^T$



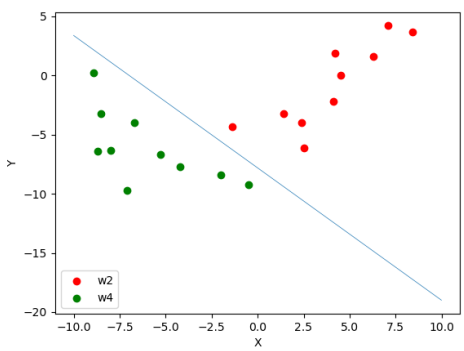
2. (a) $a_0 = (0\ 0\ 0)^T$ $b_0 = (1, 1 \cdots 1)^T$

迭代10000次后误差：8.45



(b) $a_0 = (0\ 0\ 0)^T$ $b_0 = (1, 1 \cdots 1)^T$

迭代10000次后误差：1.56×10^{-4}



3. $X_{3\times32}$ 为4个类前8个样本 $W_{3\times4}$ 为权重参数 $Y_{4\times32}$ 为真实标签

$\min_W \|W^TX - Y\|^2$ $W = (XX^T)^{-1}XY^T$

$X_{3\times8}$ 为4个类后2个样本

计算公式 $Y = W^TX$

$X_i \in W_j$, $j = \text{argmax}(Y_{ji})$