2. ENSEMBLE MODELS

a) Let's consider the following pairs of points

1. $x^1 = (0,2)$ and $x^3 = (0,0)$

They have the same x_1 but different x_2, and then they are categorized into different groups. Considering maximizing the margin, I chose their midpoint to be on the decision boundary. Then, we can find the first $g(x)$, which is $g(x) = 1_{(x_2 > 1)}$.

2. $x^2 = (2,0)$ and $x^3 = (0,0)$

Similarly, they have the same x_2 but different x_1, and then they are categorized into different groups. Considering maximizing the margin, I chose their midpoint to be on the decision boundary. Then, we can find the first $g(x)$, which is $g(x) = 1_{(x_1 > 1)}$.

3. $x^1 = (0,2)$ and $x^4 = (-2,2)$.

Similarly, they have the same x_2 but different x_1, and then they are ~~recog~~ categorized into different groups. Considering maximizing the margin, I chose their midpoint to be on the decision boundary. Then, we can find the first $g(x)$, which is $g(x) = 1_{\{x_1 > -1\}}$.

4. $x^2 = (2,0)$ and $x^4 = (-2,-2)$.

The decision of this pair has been covered in previous cases already. Assume weights are equal, we then have $f(x^{(1)}) = f(x^{(4)}) = 2\alpha$, $f(x^3) = f(x^4) = \alpha$, aligning with the requirement.

Then, we need to find an α where $\alpha \leq 0.5$ and $2\alpha > 0.5$, where $\alpha = 1/3$ can be an option.

Based on the constraints to c's, we can reach a $f(x^i)$ as

$$f(x^i) = \alpha(g_1(x^i)) + g_2(x^i) + g_3(x^i)) = \frac{1\{x_1^i > -1\} + 1\{x_1^i > 1\} + 1\{x_2^i > 1\}}{3}$$

b.