h \ f	+1	-1
+1	0	1 FP.
-1	10 FN	0

6. $\because f_{MKT}(\vec{x}) = \text{sign}(P(y=+1 \mid \vec{x}) - \alpha)$

$\therefore$ if
$$\begin{cases} P(y=+1 \mid \vec{x}) > \alpha, & \text{then } f_{MKT}(\vec{x}) = +1 \\ P(y=+1 \mid \vec{x}) \leq \alpha, & \text{then } f_{MKT}(\vec{x}) = -1 \end{cases}$$

If we consider the points on the decision boundary, the expected loss for assigning any such $\vec{x}$ to either side should be the same (because the decision boundary is the place where we believe to have same probability to classify points to both sides)

Therefore, for $\vec{x}$ on the boundary, we have this equality holds:

(FN) (FP) the probability of having the point $\vec{x}$ (which is on the boundary) to have true label $y=-1$

$$10\, \underline{P(y=+1 \mid \vec{x})} = 1 \cdot \underline{P(y=-1 \mid \vec{x})}$$

$$\Rightarrow 10\, P(y=+1 \mid \vec{x}) = 1 \cdot (\underline{1 - P(y=+1 \mid \vec{x})})$$

$$\Rightarrow 10\, P(y=+1 \mid \vec{x}) = 1 - P(y=+1 \mid \vec{x})$$

$$\Rightarrow 11\, P(y=+1 \mid \vec{x}) = 1$$

$$\Rightarrow P(y=+1 \mid \vec{x}) = \frac{1}{11}$$

Therefore, we assign α as $\alpha = \frac{1}{11}$, making $f_{MKT}(\vec{x}) = \text{sign}(P(y=+1 \mid \vec{x}) - \frac{1}{11})$ $\square$

(because this means:

if $P(y=+1 \mid \vec{x}) > \frac{1}{11}$, then $f_{MKT}(\vec{x}) = 1$

$\rightarrow$ we only need the probability to be more than $\frac{1}{11}$ (but not 0.5) to make the model classify $\vec{x}$ to be a member (+1)

$\rightarrow$ we classify a customer to be a member more often because the cost of FN is greater.)