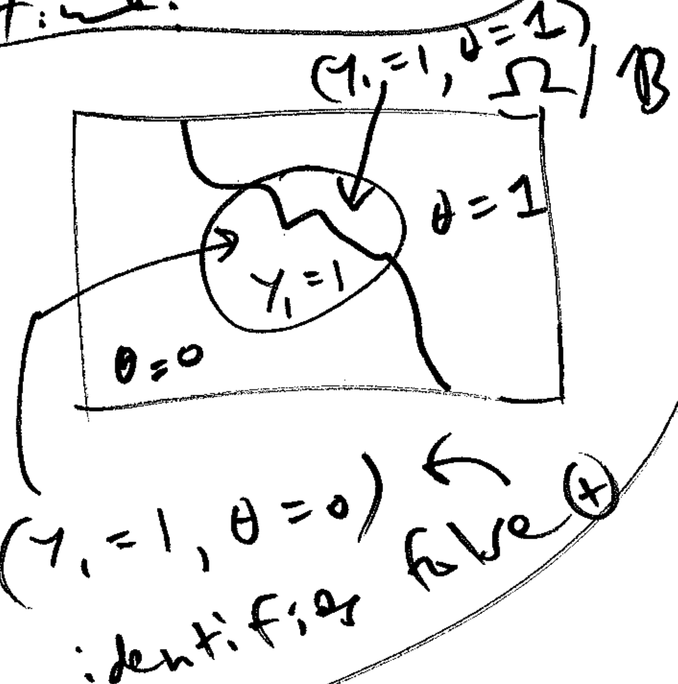
this time: probability foundations

next time: ↓

(same reading as before)



$p(Y_1 = 1 \mid \mathcal{B})$

false positive rate

$p(\theta = 0 \mid Y_1 = 1, \mathcal{B})$

$$p(Y_1 = 1, \theta = 0 \mid \mathcal{B}) = p(Y_1 = 1 \mid \theta = 0, \mathcal{B}) \cdot \boxed{?}$$

$$\| $$

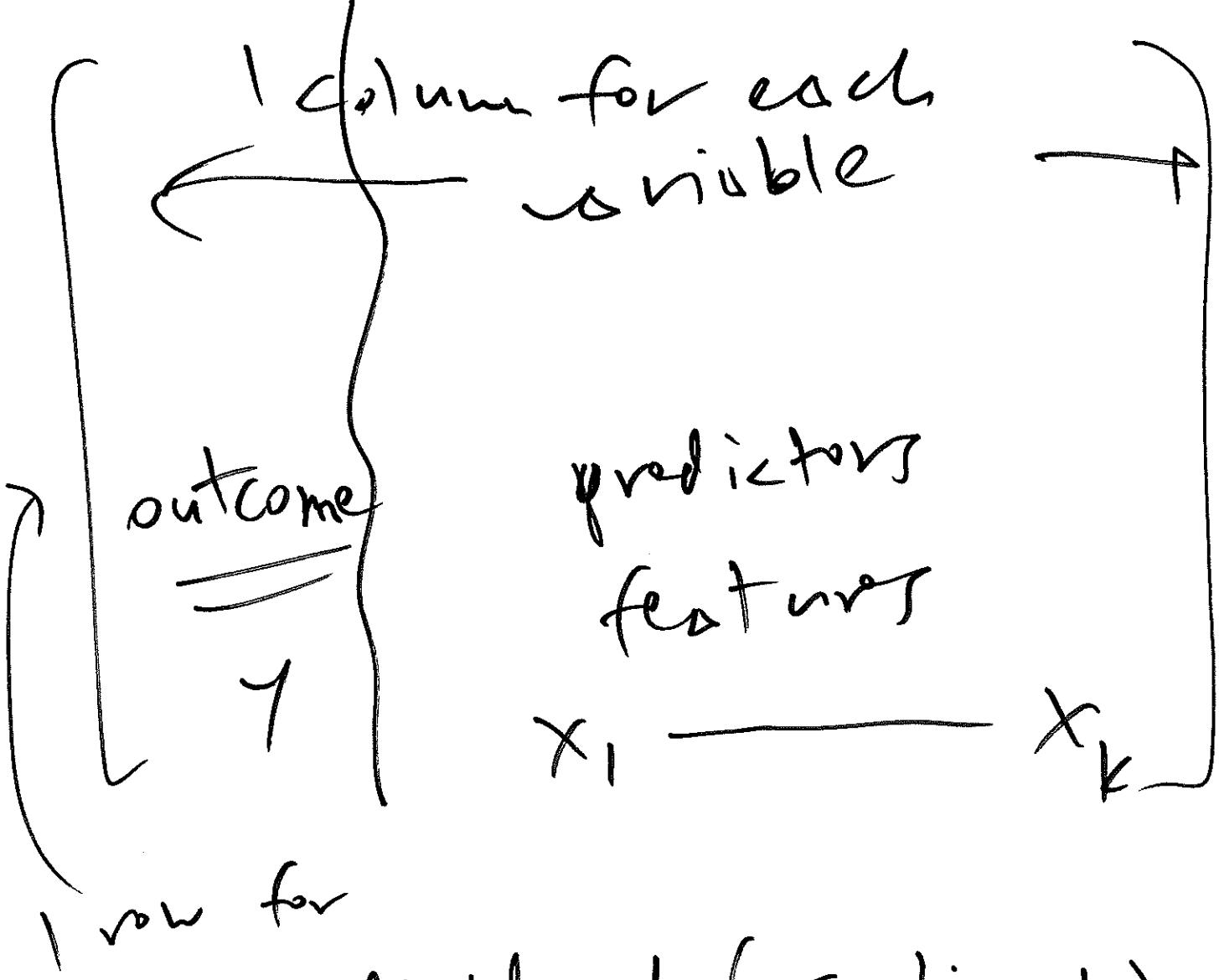
$$\frac{p(Y_1 = 1, \theta = 0, \mathcal{B})}{p(\mathcal{B})} = \frac{p(Y_1 = 1, \theta = 0, \mathcal{B})}{p(\theta = 0, \mathcal{B})} \cdot \frac{p(\theta = 0, \mathcal{B})}{p(\mathcal{B})}$$

$p(\theta = 0 \mid \mathcal{B})$

CS1 $(a \mid \mathcal{B}) = \{a_1, a_2, a_3\}$

a_1 = (only Determine) (WB) a_2 = (initially only D; if D neg, conclude neg; if D ⊕, do WB)

a_3 = (only Western Blot)



quant. 0 1 .. 5 (999) ← missing data

mass spec.

blood test	HIV+ $\theta=1$	HIV- $\theta=0$	
+	$\alpha\beta$	$(1-\gamma)(1-\alpha)$	$\alpha\beta + (1-\gamma)(1-\alpha)$
−	$\alpha(1-\beta)$	$\gamma(1-\alpha)$	$\alpha(1-\beta) + \gamma(1-\alpha)$
	α	$1-\alpha$	1

✓ α = prevalence

✓ β = sensitivity

γ = specificity

$0 \leq \alpha, \beta, \gamma \leq 1$

false positive rate = FPR $= \dfrac{(1-\gamma)(1-\alpha)}{\alpha\beta + (1-\gamma)(1-\alpha)}$

false negative rate $= \dfrac{\alpha(1-\beta)}{\alpha(1-\beta) + \gamma(1-\alpha)}$