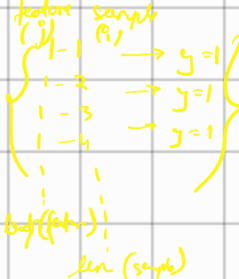
	Messages (x)	y	word "free"	word "win"	Label
1.	Free win now	Spam	Yes	Yes	Spam (1)
2.	Win a prize	Spam	NO	Yes	Spam (1)
3.	Hello! How are you	Not Spam	No	No	Not spam (0)
4.	Let's win it	Not Spam	No	Yes	Not spam (0)
5.	Free lunch today	Not spam	Yes	No	Not spam (0)



Step 1 – Calculate prior probability

test message "Free win"
Yes Yes

For Spam class

$Pr(y=1) = 2/5$ $\quad Pr(y=0) = 3/5$

Total "Yes" / Total sample in class (Y)

(Free) $\theta_1 | y=1 = \frac{1}{2}$ $\quad$ (Free) $\theta_1 | y=0 = \frac{1}{3}$

(win) $\theta_2 | y=1 = \frac{2}{2}$ $\quad$ (win) $\theta_2 | y=0 = \frac{1}{3}$

Inference Phase

Free = Yes $\quad$ win = yes

$$Pr(y=1|x) = \frac{P(x|y=1)\,P(y=1)}{P(x|y=1)\,P(y=1) + P(x|y=0)\,P(y=0)}$$

Not considering →

$$P(x|\text{spam}) = P(x_1, x_2 | \text{spam})$$

$$Pr(\text{Spam}|x) = P(x_1|\text{spam}) \times P(x_2|\text{spam}) \times P(\text{spam})$$

$$= \frac{1}{2} \times \frac{2}{2} \times \frac{2}{5} = 1/5$$

$$P(\text{Not spam}|x) = \frac{1}{3} \times \frac{1}{3} \times \frac{3}{5} = \frac{1}{15}$$

$$= 0.066$$

$$P(\text{Spam}|x) > P(\text{Not spam}|x)$$

$$0.2 > 0.066$$

test is spam.