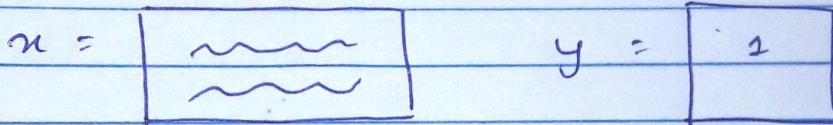
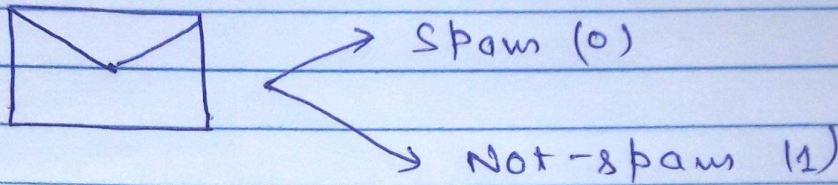


## ② Bayes Example - Spam or Not?

Bayes Theorem for classification



$$P(y/x) = \frac{P(x/y) P(y)}{P(x)}$$

$$\textcircled{1} \quad P(\underline{y=1} | x) = \frac{P(x | y=1) P(y=1)}{\cancel{P(x)}}$$

0.7

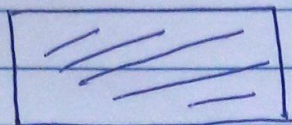
$$\textcircled{2} \quad P(\underline{y=0} | x) = \frac{P(x | y=0) P(y=0)}{\cancel{P(x)}}$$

0.3

final Prediction = max  $\textcircled{01}$  and  $\textcircled{02}$   
= argmax  $(P(y_i | x))$

While taking argmax we can ignore  $P(x)$  in both to avoid unnecessary calculation of  $P(x)$





100 emails

60 email spam

40 Not spam

$$P(y=0) = 0.6$$

$$P(y=1) = 0.4$$

prior probability

Hence,

$$P(y=c|x) \propto \text{likelihood} \cdot \text{prior probability}$$

$x = [ \text{"get unlimited data, 95% off"} ]$

features

$x = [ \text{"i am in meeting"} ]$

$$P(x|y=0) = 0.8$$

$$P(x|y=1) = 0.2$$

likelihood

After checking features in spam and not spam mail, we calculate  $P(x|y_i)$

$$\text{max}(\text{arg}) (0.8 \times 0.6, 0.2 \times 0.4) = 0.48$$

spam