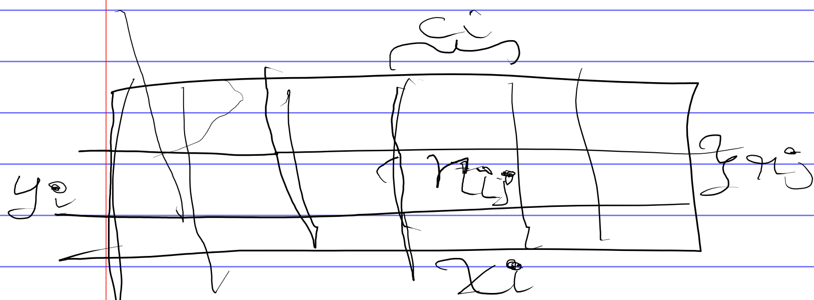

$P(\text{picking up } i^{th} \text{ fruit}, j^{th} \text{ basket}) = \frac{n_{ij}}{N}$

joint probability

Marginal Probability: $P(X = x_i) = \frac{c_i}{N}$

Conditional probability: $P(X = x_i / Y = y_i) = \frac{n_{ij}}{c_i}$

Sum rule: You know this already

Bayes Theorem: $\boxed{P(Y/X) = \frac{P(X/Y) \cdot P(Y)}{P(X)}}$

Proof: $P(X,Y) = P(X/Y)P(Y)$
$= P(Y/X)\,P(X)$

$P(X/Y)P(Y) = P(Y/X)P(X)$

$$\boxed{P(X/Y) = \frac{P(Y/X)\,P(X)}{P(Y)}}$$

$$P(Y) = \sum_X P(Y/X)\,P(X)$$

98% correct positive, 97% correct negative

X = The guy has cancer

Y = The ~~test~~ returns +ve

$P(Y=+/X=+) = 0.98$

$P(Y=-/X=-) = 0.97$

$P(X) = 0.008$

$$P(X=+/Y=+) = \frac{P(Y/X)P(X)}{\sum P(Y/X)P(X)}$$

$$= \frac{0.98 \times 0.008}{0.98 \times 0.008 + 0.03 \times 0.992}$$

$992 \times 3 = 2976$

$98 \times 8 = 784$

$$= \frac{0.00784}{0.00784 + 0.02976} \approx 20\%$$

The idea is that very few people are actually positive