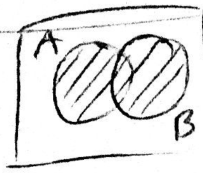
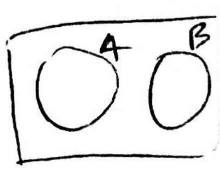
Addition rule

$$\boxed{P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)}$$



count1	count2
3	4

if A and B are disjoint



$$P(A \text{ or } B) = P(A) + P(B)$$

Multiplication Rule

$$\boxed{P(A \text{ and } B) = P(A)P(B|A)} \leftarrow$$

if A and B are independent

$$P(A \text{ and } B) = P(A)P(B)$$

complements $\overline{A}$ is the complement of A

$$P(\overline{A}) = 1 - P(A).$$

$$\boxed{P(\overline{A}|B) = 1 - P(A|B)} \checkmark\checkmark$$

$$P(A|\overline{B}) \neq 1 - P(A|B) \quad \times\times\times$$

conditional probability

$$P(B \mid A) = \frac{P(A \text{ and } B)}{P(A)}$$

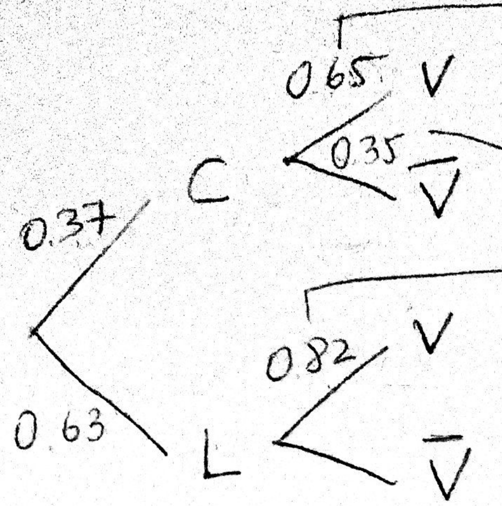
$$P(A \mid B) = \frac{P(A \text{ and } B)}{P(B)}$$

Bayes theorem:

$$P(A \mid B) = \frac{P(B \mid A)\,P(A)}{P(B)}$$

$$P(B \mid A) = \frac{P(A \mid B)\,P(B)}{P(A)}$$

1)



$P(V|C) = 0.65$

$P(\bar{V}|C) = 0.35$

$P(V|L) = 0.82$ $P(V) = 0.7571$

$P(C) = 0.37$.

C: conservative party
L: liberal party. Note that $L = \bar{C}$
V: vote
$\bar{V}$: no vote

a) $P(L) = P(\bar{C}) = 1 - P(C) = 1 - 0.37 = 0.63$

b) $P(L|V) = \dfrac{P(V|L)\,P(L)}{P(V)}$: Bayes theorem.

$$= \frac{0.82 \cdot 0.63}{0.7571} = 0.6823$$

$(P(V|L) =)$

c) $P(C \text{ and } \bar{V}) = P(\bar{V}|C)\,P(C)$

$$= 0.35 \cdot 0.37 = 0.1295$$

2)

a) ~~8~~ we assume that x follows the Binomial distribution with $n=8$. and $p=0.1$.

- fixed number of trials
- trials are independent
- the only two outcomes are: diseased or not.
- the probability of disease is the same for each individual.

b) compute the probability that only one of the individuals has the disease from the group of 8.

$\boxed{n=8,\ p=0.1,\ X=1}$

$P(1) = 0.3826$

$$P(X) = \frac{8!}{(8-x)!\,x!}\,0.1^{x}\,(1-0.1)^{8-x}$$

c) mean. $\mu = n \cdot p = 8 \cdot 0.1 = 0.8$.

variance: $\sigma^2 = np(1-p) = 8 \cdot 0.1 \cdot 0.9 = 0.72$

d) $\mu + 2\sigma = 0.8 + 2 \cdot \sqrt{0.72} = 2.4970$

$\mu - 2\sigma = 0.8 - 2\sqrt{0.72} = -0.8970$.

the value 5 is significantly high. the sample evidence (5 disease out of 8) does not support the assumption regarding the population ($p=0.1$)