Statistics: a study of uncertainty
measured by probability

3 frameworks:

→ Classical: equally likely outcome
(eg: rolling dice)

→ Frequentist: relative frequency
(how many times it occurs / freq)

→ Bayesian:
personal perspective
↓
based on my own info/belief

h → win → $3
t → lose → $4

$3\left(\frac{1}{2}\right) - 4\left(\frac{1}{2}\right)$
$= \frac{3}{2} - 2 = 1.5 - 2 = -.5$

Conditional Probability:

Probability of A under condition B:

$$P(A|B) = \frac{P(A \cap B)}{P(B)}$$

If probability of B doesn't depends on A:

$$P(A|B) = P(A)$$

$$P(A \cap B) = P(A) \cdot P(B)$$

Bayes Theorem:

conditional prob. → $P(A|B) = \frac{P(A \cap B)}{P(B)}$

in other way → $P(B|A) = \frac{P(B \cap A)}{P(A)}$

$$\Rightarrow P(B|A) \cdot P(A) = P(B \cap A) = P(A \cap B)$$

Bayes theorem ⟹

$$P(A|B) = \frac{P(B|A) \cdot P(A)}{P(B)}$$

Problem: Let's say there 2 children & 1 is surely girl what's the probability of both are girl

$$P(2\text{Girl} \mid 1\text{Girl}) = \frac{P(1\text{Gr} \mid 2\text{Gr}) \cdot P(2\text{Gr})}{P(1\text{Gr})}$$

Probability of 1 G among 2 girls sur

$$= \frac{1 \cdot 1/4}{3/4}$$

GG GB BG

$$= \frac{1}{3}$$

Gr = Girl

B = Boy

Same equations :

$$P(A|B) = \frac{P(A \cap B)}{P(B)}$$ [conditional]

$$= \frac{P(B|A) \cdot P(A)}{P(B)}$$ [bayes]

$$= \frac{P(B|A) \cdot P(A)}{P(B|A) \cdot P(A) + P(B|A^c) \cdot P(A^c)}$$ [bayes]