Probability

$(H|T) \longrightarrow \underline{H}$

$P\left(\dfrac{\text{Shore of SU}}{\text{Total}}\right) = \dfrac{H}{H,T} = \dfrac{1}{2}$

① **Experiment** → A repeatable procedure with a set of possible results. Ⴔ tossing a coin

② **Sample space** → All possible outcome of an experiment. Sample space — Head & tail.

③ **Event.** → One or more outcome of Experiment.

✝ **Basic counting principle** ✓

$$P(H) = \tfrac{1}{2} = \underline{0.5}$$

→ m ways to do one thing
and n way to do another thing
then there are total $\underline{m \times n}$ ways to do both the things.

✓ 3 shirts,
✓ 4 jeans ⟶ 3×4 ⟶ Unique Combination

3 icecream flavour — 4 cones → $4 \times 3 = \underline{12}$

More than two choices

option1 → Sedan or SUV
option-2 — $C_1\ C_2\ C_3\ C_4\ C_5$
option-3 → 3 models (M_1, M_2, M_3)

My new car

$2 \times 5 \times 3 = 30\ \text{ways.}$

Sedan   SUV
$C_1\ C_2\ C_3\ C_4\ C_5$ $C_1\ C_2\ C_3\ C_4\ C_5$
1 2 3   1 2 3
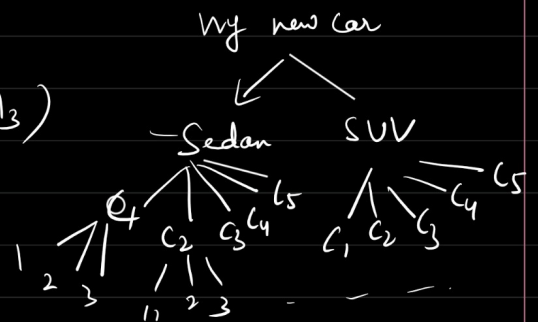
independent event — Basic counting work on independent event.

Probability principles

What is Probability ??

$$\text{Prob.} = \text{Share of Success} / \text{Total no of Possible outcomes}$$

→ Relative frequency of H

Coin → 2

$$P(H) = \frac{1}{2} ✓$$

① The exact outcome cannot be predicted. (exception)

② All possible outcomes are known.

③ Equally likely outcomes.

④ Repeatable under uniform condition.

Sholay

Head

* Probability rules

① for any event A, $0 \leq P(A) \leq 1$ → Why

dice → 1, 2, 3, 4, 5, 6

$$P(0) \to 0$$

tossip a coin

Success → (H, T)

= total no of (H, T) outcom-

② Sum of all probs = 1.

$$P(H) + P(T) = 1$$
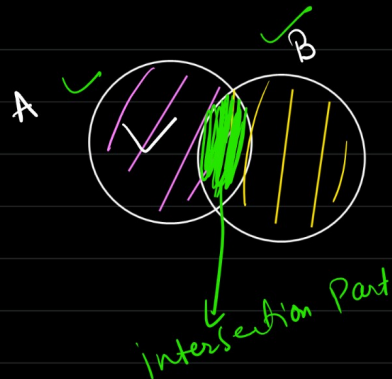
$$P(H) = 1 - P(T) \quad (\text{Rule of Subtraction})$$

③ Complement rule →

$$P(\text{not } A) = 1 - P(A)$$

④ General addition rule

For any two event

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

Special case of disjoint events ⟶ $P(A \text{ or } B) = P(A) + P(B)$

$P(A \text{ and } B) \to 0$

Can not occur Together

$A + B - A \cap B$

⇓

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

intersection Part

disjoint → ◯ ◯

$\dfrac{A \text{ and } B}{\Downarrow}$ ◯

⑤ General multiplication Rule

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

Prob A when B has occurred

Special Case   A and B are independent.

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

$P(A/B)$

✓ Conditional Prob
✓ independent event ⟶ does not affect each other.

ex.   I having breakfast and Mr Modi presenting
a report in Lok sabha

⇓

10 am

eg   I having breakfast / youtub , India will win
the current fest

10 am

disjoint
→ horoscope head not sanstha
left & right
→ Sunrise in east
& sunset
in west

Conditional prob

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

$\Downarrow$

Prob of A when B has occurred

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

A   B
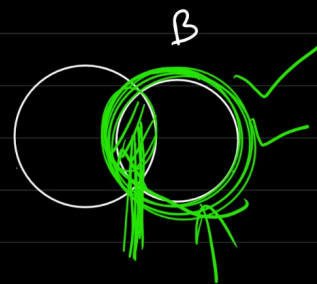
Q. 16 people study french, 21 study spanish there are 30 people altogether.

Work on prob.?

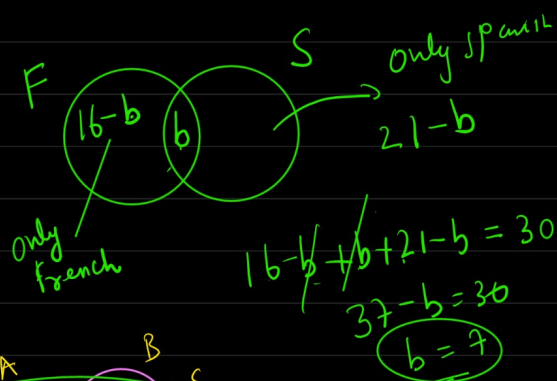$P(F) \rightarrow \boxed{\frac{16}{30}}$

$P(S) \rightarrow \frac{21}{30}$

$P(\text{French only}) = \frac{9}{30}$

$P(\text{Spanish only}) = \frac{14}{30}$

$P(F \text{ or } SP)$ $P(F \text{ and } S) = \frac{7}{30}$

$\longrightarrow \frac{30}{30} = 1$

F   S $\rightarrow$ only spanish

$16-b$ b $21-b$

only french
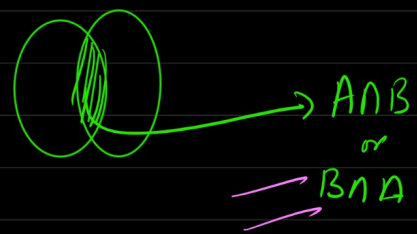
$16-b+b+21-b = 30$

$37-b = 30$

$\boxed{b=7}$

A   B   S

F
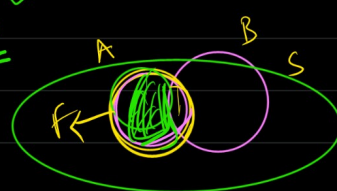
Bayes Theorem

Conditional Prob $= P(A/B) = \frac{P(A \cap B)}{P(B)}$

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

$P(B/A) \cdot P(A) = P(B \cap A) \quad —①$

$P(A/B) \cdot P(B) = P(A \cap B) \quad —②$

$\rightarrow A \cap B$

or

$B \cap A$

equality ① & ②

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

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

※ What is prob and getting 3 → 1/6

2 or 3 ⟶ 2/6 ⟹ 1/3

① Union   A = {1,2,3}   A

B = {3,4,5}

$$A \cup B = \{1, 2, 3, 4, 5\}$$

A | B ⤵ → A.Union (B)

② Intersection

③ → $A \cap B = \{3\}$ → A ≧ B   A.intersection (B)

↳ difference Ⓐ - B ⟹ {1,2}   A - B

A.difference (B)

④ Symmetric diffe — A ∧ B | A.symmetric diff (B)
{1,2,4,5}