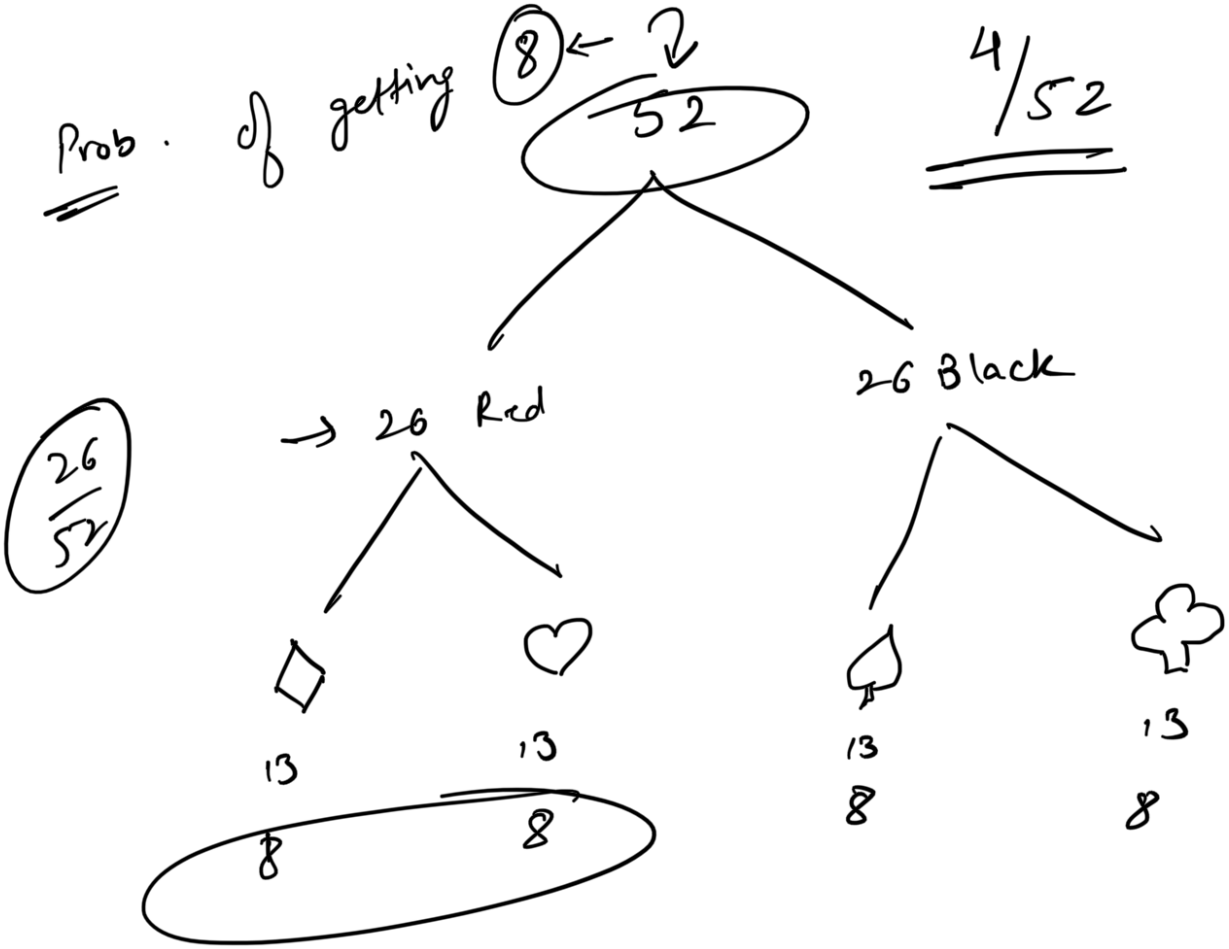
Conditional Probability

→ Prob. of an event A occurring given that another event B has occurred.

⇒ P(A|B) - Probability of A given B.

Prob. of getting (8) ← 2 / 52 = 4/52



Q: Prob. of getting 8 given that it is a red card. (B)

A

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

$$P(\text{getting 8} \mid \text{it is red card}) = \frac{2/52}{26/52} = \frac{2}{26} = \frac{1}{13}$$

getting 8 & a red card

Q1.

Swiggy — 60%

Zomato — 50%

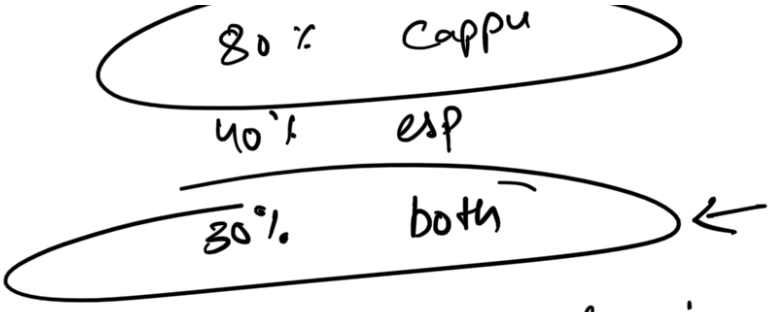
Both — 20%.

$$P(\text{zomato} \mid \text{swiggy}) = \frac{P(\text{zomato} \cap \text{swiggy})}{P(\text{swiggy})}$$

$$= \frac{20\%}{60\%}$$

$$= 20/60$$

Q.



Given cappu user, what fraction of people like espresso?

Total Probability Law

$$P(A) \text{ Prob. of event } (A) = \sum_{i=1}^{N} \left[P(A \mid B_i) \times P(B_i) \right]$$

$$\Rightarrow P(A \mid B) = \frac{P(A \cap B)}{P(B)} \leftarrow \text{Cond}^{n} \text{ prob.}$$

$$\Rightarrow P(A \cap B) = P(A \mid B) \times P(B)$$

(Intersection)

$$P(C) = P(C \mid A)\, P(A) + P(C \mid B)\, P(B)$$

Q:

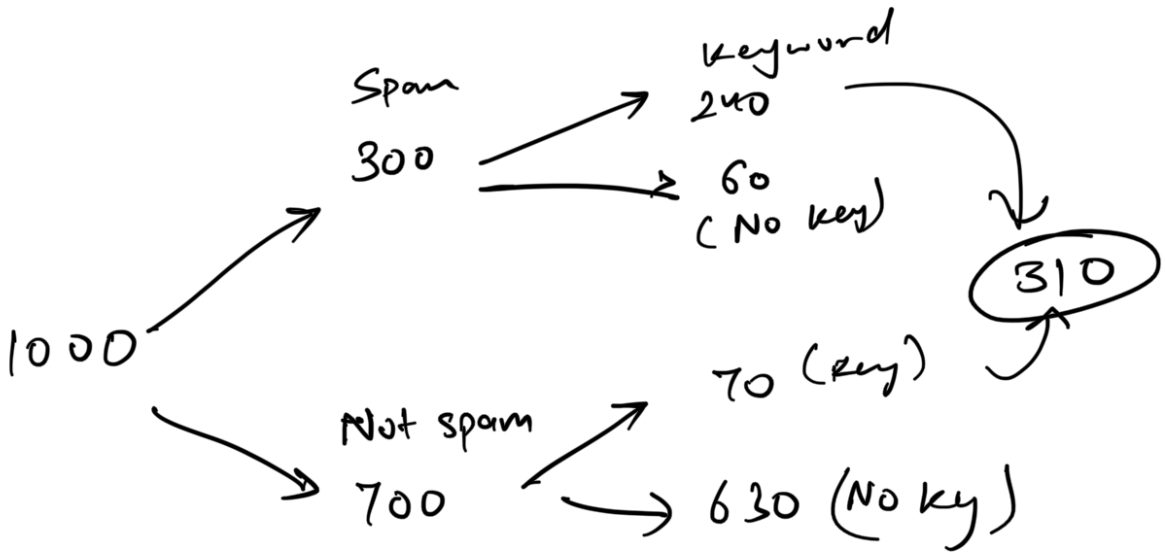
$P(S)$ — 30% emails are spam

$P(S^c)$ — 70% Emails are NOT

$P(K|S)$ — "Purchase" occurs in 80% of spam emails.

$P(K|S^c)$ — "Purchase" occurs in 10% of non-spam emails.

⇒ Overall, in what % of emails, would we see the "purchase" keyword?



310 / 1000 = 31%

$$P(K) = P(K|S) \times P(S) + P(K|S^c) \times P(S^c)$$

$= 80\% \times 30\% + 10\% \times 70\%$

$= 0.24 + 0.07$

$= 0.31$

$P(D) = P(D|A) \times P(A) + P(D|B) \times P(B) + P(D|C) \times P(C)$

$P(A) = \sum_{i=1}^{N} [P(A|B_i) \times P(B_i)]$

B_1

B_2

B_3

$\vdots$

B_n

Q:

→ Premium uses — 5% ✓

→ Non-premium — 95% ✓

↓

(— 1 D) — 10%.

$P(J \mid \text{Prem}) \rightarrow (J \mid \text{Prem})$

$P(J \mid \text{Not Prem}) - 2\%$

10%

$$P(J) = P(J \mid P) \times P(P) + P(J \mid \text{Not } P) \times P(\text{Not } P)$$

$$= 10\% \text{ of } 5\% + 2\% \text{ of } 95\%$$

$$= (0.1 \times 0.05 + 0.02 \times 0.95) \times 100$$

$$= 2.4\%$$

Q:

Type A – 60%

Type B – 40%

CTR | A – 5%

CTR | B – 3%

$$5 \times 0.60 + 3 \times 0.40$$

$$\Rightarrow 4.2\%$$

$$P(S_A \mid E_x) = \frac{P(S_A \cap E_x)}{P(E_x)}$$

Q

$E_x \rightarrow n \quad 0.5$

$E_x^c \rightarrow 1-n \quad 0.5$

$A \mid E_x \rightarrow 0.6$

$A \mid E_x^c \rightarrow 0.2$

$P(A)$

Q:

- 90% → 70% promoter
- 40% → 20% N
- 5% → 10% D

$90 \times 0.7 + 40 \times 0.2 + 5 \times 0.1$

$63 + 8 + 0.5$

71.5