Note

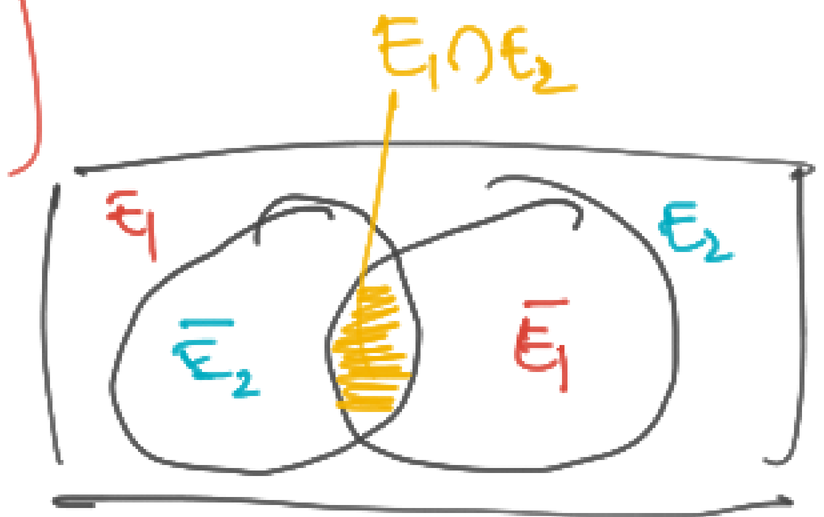
① $P(\phi) = 0$

② If E be any event that probability of non-happening / non-occurrence is denoted by $P(\bar{E})$ or $P(E')$. It is given by

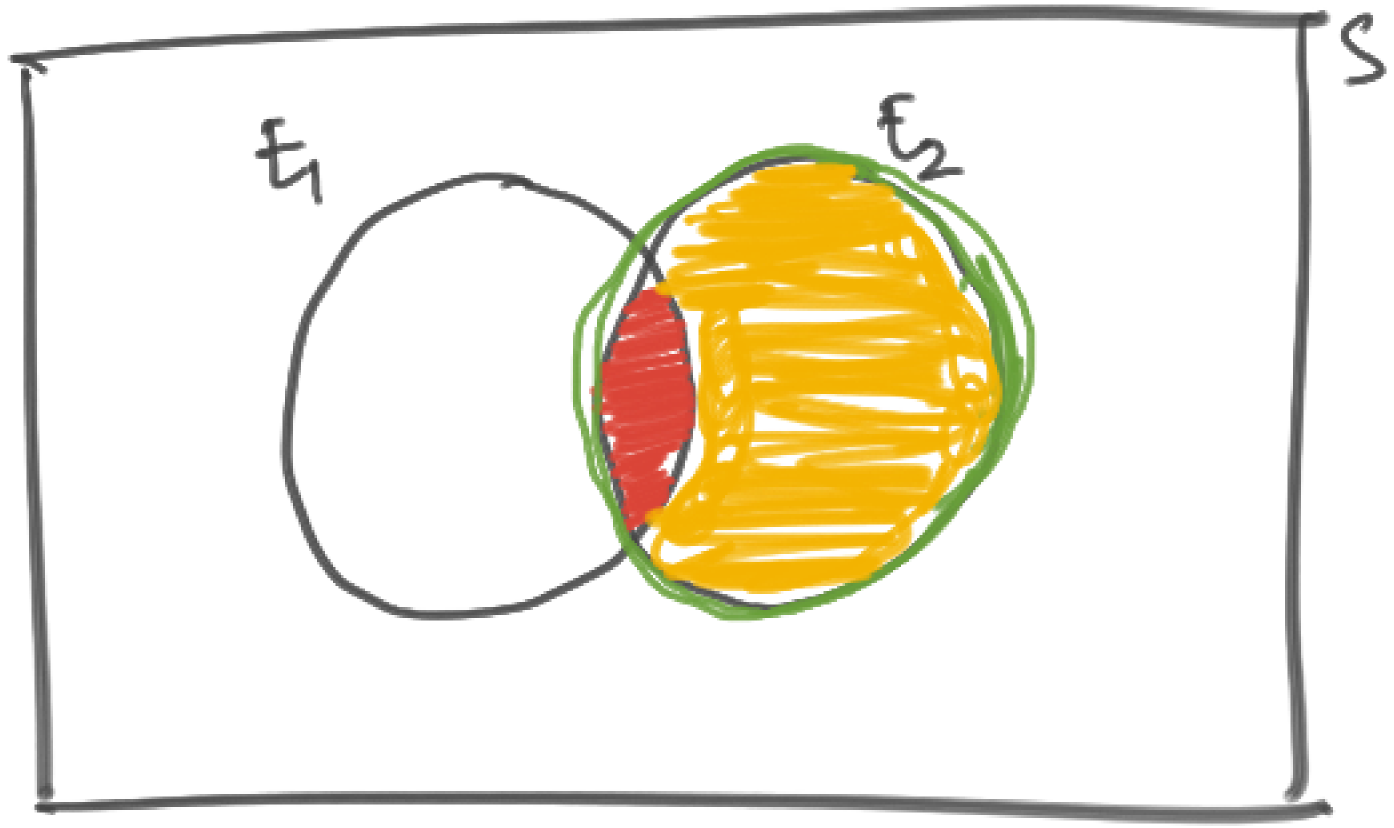
$$P(\bar{E}) = 1 - P(E)$$

$$\boxed{\sum_i P(E_i) = 1}$$

$$\boxed{\text{Prob. (occurrence)} + \text{Prob. (non-occurrence)} = 1}$$



③ $P(\bar{E}_1 \cap E_2) = P(E_2) - P(E_1 \cap E_2)$



$E_1 \cap E_2$

$$E_2 - (E_1 \cap E_2) = \overline{E_1} \cap E_2$$

(4) $P(E_1 \cup E_2) = P(E_1) + P(E_2) - P(E_1 \cap E_2)$

| M.E = mutually exclusive

If E_1 and E_2 are M.E. then $E_1 \cap E_2 = \phi$ i.e. $P(E_1 \cap E_2) = 0$

$\therefore P(E_1 \cup E_2) = P(E_1) + P(E_2)$

(5) $P(E_1 \cup E_2 \cup E_3) = P(E_1) + P(E_2) + P(E_3) - P(E_1 \cap E_2) - P(E_2 \cap E_3) - P(E_3 \cap E_1)$
$+ P(E_1 \cap E_2 \cap E_3)$

If E_1, E_2, E_3 are M.E then ?

Conditional Probability

let E_1 and E_2 be two events of a random experiment.
Then Probability of occurrence of E_1 given that E_2 has already occurred is denoted $P(E_1/E_2)$ and is defined as

$$P(E_1/E_2) = \frac{P(E_1 \cap E_2)}{P(E_2)} \quad , \quad P(E_2) \neq 0 .$$

Note

① $P(S/E) = P(E/E) = 1$

$$P(S/E) = \frac{P(S \cap E)}{P(E)} = \frac{P(E)}{P(E)} = 1$$

② $P\left((E_1 \cup E_2)/F\right) = P(E_1/F) + P(E_2/F) - P\left((E_1 \cap E_2)/F\right)$

③ $P(\bar{E}/F) = 1 - P(E/F)$

Multiplicative law of Probability

The Probability of simultaneous occurrence of two events is equal to the probability of one multiplied by the conditional probability of the other.

For two events E_1 and E_2

$$P(E_1 \cap E_2) = P(E_1)\,P(E_2/E_1) \quad ; \quad P(E_1) \neq 0$$

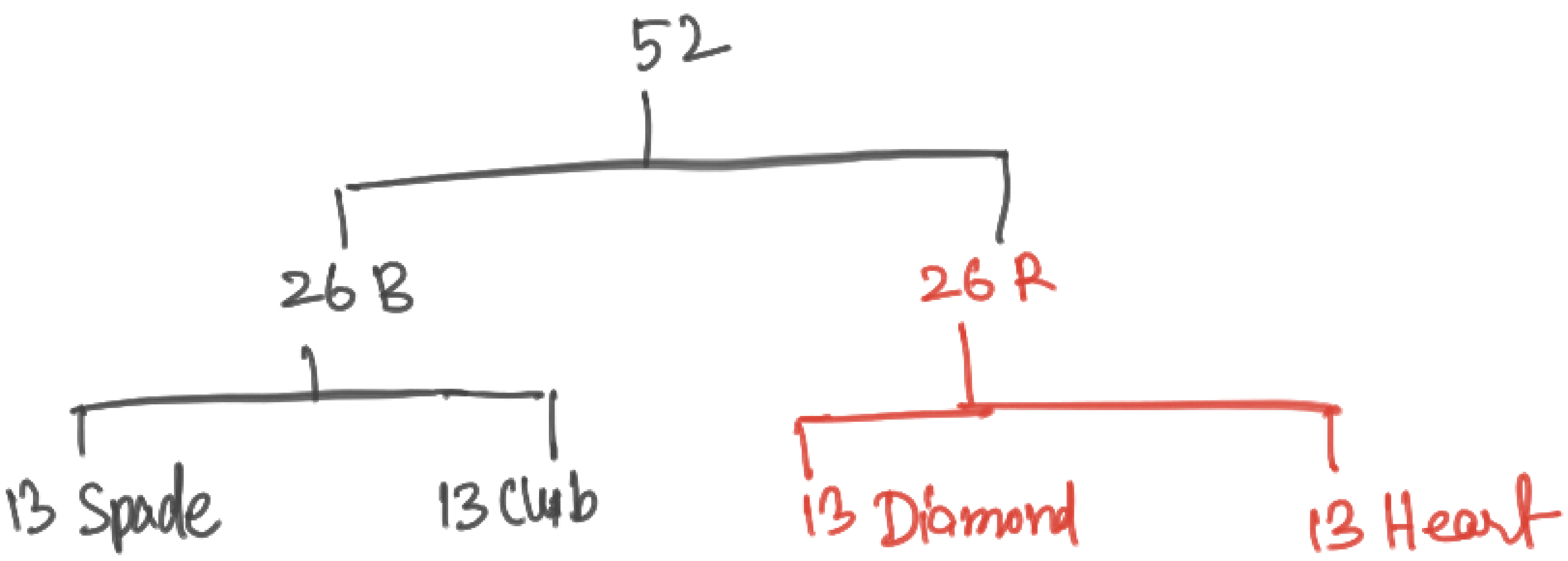
or $$P(E_1 \cap E_2) = P(E_2)\,P(E_1/E_2) \quad ; \quad P(E_2) \neq 0$$

Note

1. $P(E_1 \cap E_2)$ is also written as $P(E_1 E_2)$

2. If E_1 and E_2 are independent events then

$$P(E_1 \cap E_2) = P(E_1)\,P(E_2)$$



↓

FACE CARDS
- 1 King
- 1 Queen
- 1 Jack

1 Ace (A)

2–10 numbers

Q. A card is drawn from a well shuffled deck of 52 cards and then a 2nd card is drawn. Find the probability that the first card is a spade and second card is a club if the first card is not replaced.

and $\rightarrow \cap \rightarrow \times$
or $\rightarrow \cup \rightarrow +$

Soln:

let, S = getting the first card a spade

C = getting the 2nd card a club

Now,

$$P(S \cap C) = P(S)\,P(C/S) \text{ ——— } (1)$$

Here,

$P(S)$ = Probability that the 1st card is spade $= \dfrac{^{13}C_1}{^{52}C_1}$

$= \dfrac{13}{52}$

$P(C/S)$ = Probability that 2nd card is club given that 1st card was spade

$= \dfrac{^{13}C_1}{^{51}C_1}$ ($\because$ Replacement doesn't occur)

$= \dfrac{13}{51}$

From (1)

$$P(S \cap C) = \left(\frac{13}{52}\right) \times \left(\frac{13}{51}\right) = ?$$

Q. A problem in physics is given to three students A, B and C whose chances of solving it are $\frac{1}{2}, \frac{1}{3}, \frac{1}{4}$ respectively. What is the probability that the problem will be solved?