Topics *to be covered*

A All the basic terminologies

B Questions

All Concepts of Probability From Basic and Important Questions

INTRODUCTION

संभावना

- The word 'probability' is commonly used in our day-to-day conversation and we generally use this word even without going into the details of its actual meaning. Generally, people have a rough idea about its meaning. In our day-to-day life we come across statements like:

(i) Probably it may rain today.

(ii) He may possibly join politics.

(iii) Indian Cricket team has good chances of winning World-Cup.

(iv) He is probably right.

19th Nov.

INTRODUCTION

- In such statements, we generally use the terms: possible, probable, chance, likely etc. All these terms convey the same sense that the event is not certain to take place or, in other words, there is uncertainty about the occurrence (or happening) of the event in question. Thus, in layman's terminology the word 'probability', connotes that there is uncertainty about what has happened or what is going to happen? However, in the theory of probability We assign numerical value to the degree of uncertainty.

Some Terms Related To Probability

Experiment: An operation which can produce some well-defined outcomes is called an experiment. Each outcome is called an event.

Random Experiment: An experiment in which all possible outcomes are known and the exact outcome cannot be predicted in advance, is called a random experiment.

1. **Tossing A Coin**

   S = All possible outcomes = {H, T}

   Sample space

2. **Tossing Two Coin:**

S = All possible outcomes = {HH, TT, HT, TH}

3. **Throwing A Die:**

— All possibly Outcomes

$S = \{1, 2, 3, 4, 5, 6\}$

④ Throwing 2 dice together (one die two times)

All possible outcomes :-

$$\{ (1,1), (1,2), (1,3), (1,4), (1,5), (1,6),$$
$$(2,1), (2,2), (2,3), (2,4), (2,5), (2,6),$$
$$(3,1), (3,2), (3,3), (3,4), (3,5), (3,6),$$
$$(4,1), (4,2), (4,3), (4,4), (4,5), (4,6),$$
$$(5,1), (5,2), (5,3), (5,4), (5,5), (5,6),$$
$$(6,1), (6,2), (6,3), (6,4), (6,5), (6,6). \}$$

Total outcomes
$$= 36.$$

one die $= 6 = 6^1$
two dice $= 36 = 6^2$
three dice $= 6^3$

216

4. Throwing Two Dice:

$$S = \{(1, 1), (1, 2), (1, 3), (1, 4), (1, 5), (1, 6)$$

$$(2, 1), (2, 2), (2, 3), (2, 4), (2, 5), (2, 6)$$

$$(3, 1), (3, 2), (3, 3), (3, 4), (3, 5), (3, 6)$$

$$(4, 1), (4, 2), (4, 3), (4, 4), (4, 5), (4, 6)$$

$$(5, 1), (5, 2), (5, 3), (5, 4), (5, 5), (5, 6)$$

$$(6, 1), (6, 2), (6, 3), (6, 4), (6, 5), (6, 6)\}$$

5. **Tossing three coins:** [1 coin ko 3 baar toss karo]
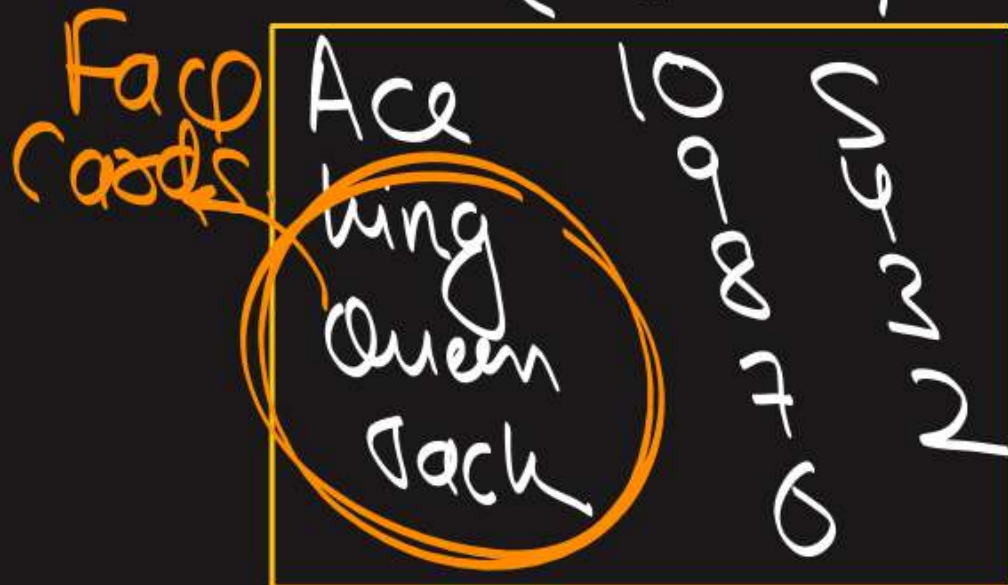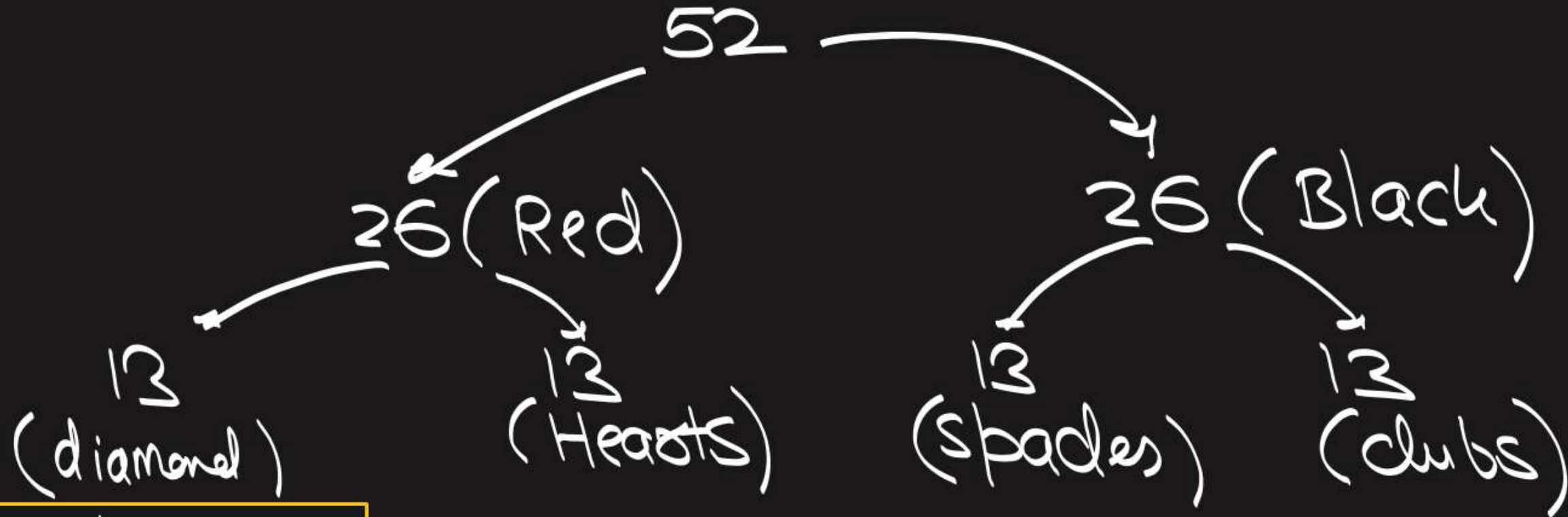
S = { HHH, HHT, HTH, THH

TTT, TTH, THT, HTT}

S = All possible Outcomes = {HHH, HHT, HTH, THH,

TTT, TTH, THT, HTT}

6. Drawing a card from a deck of 52 cards:

$$52$$

26 (Red) 26 (Black)

13 (diamond)   13 (Hearts)   13 (Spades)   13 (clubs)

Face cards:

Ace
King
Queen
Jack

10
9
8
7
6
5
4
3
2
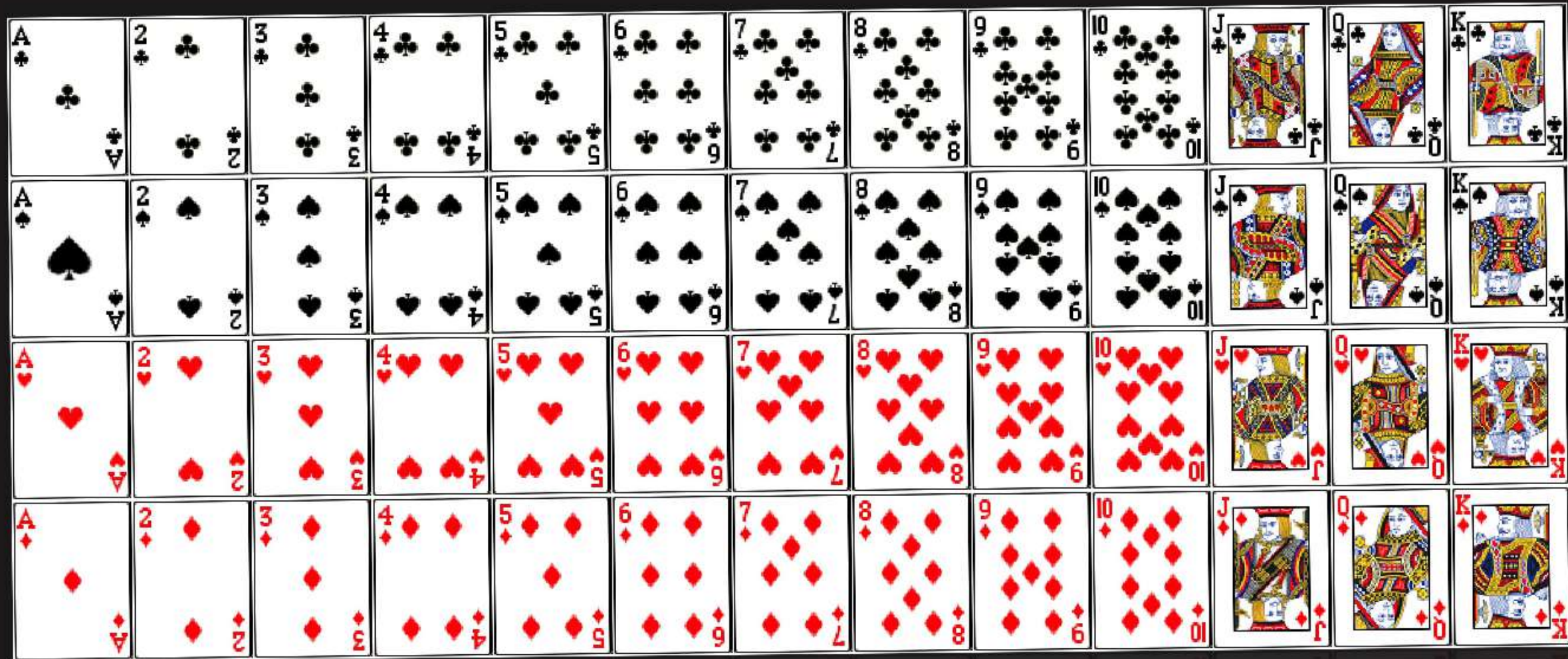
Total Face cards = 12
Total Ace's = 4
no. of Red coloured Queen = (2)

R.E. → Rolling a die

S = {1, 2, 3, 4, 5, 6}

E = die shows a '2'

E' = die does not show '2'

E_1 = Prime no. = $\{2, 3, 5\}$ = $P(E_1)$ = $\dfrac{3}{6}$ = $\dfrac{1}{2}$

E_2 = Even Prime no. = $\{2\}$ = $P(E_2)$ = $\dfrac{1}{6}$

E_3 = Multiple of 3 = $\{3, 6\}$ = $P(E_3)$ = $\dfrac{2}{6}$ = $\dfrac{1}{3}$

$$P(E) = \frac{no. \text{ of favourable outcomes.}}{\text{Total no. of outcomes.}}$$

☆ $0 < P(E) \leqslant 1$

☆ $P(E) = 0 \longrightarrow$ impossible event.

☆ $P(E) = 1 \longrightarrow$ Sure event / Certain event.

○ T/F.

① $P(E) = -5$ Ⓕ

② $P(E_1) = 0.8$ Ⓣ

③ $P(E_2) = 1.9$ Ⓕ

④ $P(E_3) = 100$ Ⓕ

⑤ $P(E_5) = 50\%$ Ⓣ

$$\frac{50}{100} = \frac{1}{2}$$ 0.5

E = '8' aaana

$$P(E) = \frac{0}{6} = ⓪$$

$E_1 =$ less than '7'.

$\{1,2,3,4,5,6\}$

$$P(E_1) = \frac{6}{6} = ①$$

R.E. → <u>Tossing two coins</u>

$S = \{HH, TT, HT, TH\}$
① ② ③ ④

E_1 = getting two heads = $\{HH\}$ → $P(E_1) = \dfrac{1}{4}$

E_2 = atleast two tails = $\{TT\}$ → $P(E_2) = \dfrac{1}{4}$

↳ kam sy kam.

E_3 = atmost two tails = $\{HH, TT, HT, TH\}$ = $P(E_3) = \dfrac{4}{4} = 1$

↳ Zada sy zada ('2' sey kam chalega) $[0,1,2]$

- Corresponding to every event A associated with a random experiment we define an event "not A" which occurs when and only when A does not occur. The event "not A" is called the negation of event A and is denoted by $\overline{A}$.

  Clearly, event A occurs if and only if $\overline{A}$ does not occur.

$\underline{R.E} \rightarrow$ Rolling a die.

$E =$ less than 4 aana. $\{1,2,3\} = P(E) = \dfrac{3}{6} = \boxed{\dfrac{1}{2}}$

$E_1 =$ More than 3 aana. $\{4,5,6\} = P(E_1) = \dfrac{3}{6} = \boxed{\dfrac{1}{2}}$

$E = 3$ aana $= P(E) = \boxed{\dfrac{1}{6}}$

$E' = 3$ nahi aana
$\qquad = P(E') = \boxed{\dfrac{5}{6}}$

E dash

E complement

Negation of E

$$P(E) + P(E') = 1$$

E = Shadi hona

E' = Shaadi nahi hona.

$P(E) + P(E') = 1$

$0.5 + P(E') = 1$

$P(E') = 1 - 0.5 = \boxed{0.5}$

#PTR

❑ Two events A and B are said to be complementary to of each other if the sum of their probabilities is 1.

❑ Probability of an event E, denoted as P(E), is given by:

$$P(E) = \frac{No.\ of\ outcomes\ favourable\ to\ E}{Total\ possible\ number\ of\ outcomes}$$

❑ For an event E, $P(\bar{E}) = 1 - P(E)$, where the event E representing 'not E' is the complement of the event E.

❑ For A and B two possible outcomes of an event,

(i) If P(A) > P(B), then event A is more likely to occur than event B.

(ii) If P(A) = P(B), then events A and B are equally likely to occur.

❑ Outcome associated with an experiment is called an event. e.g.,

(i) Getting a head on tossing a coin,

(ii) Getting a face card when a card is drawn from a pack of 52 cards.

❑ The events whose probability is one are called sure/certain events.

❑ The events whose probability is zero are called impossible events.

❑ An event with only one possible outcome is called an elementary event.

- ❏ In a given experiment, if two or more events are equally likely to occur or have equal probabilities, then they are called equally likely events.

- ❏ Probability of an event always lies between 0 and 1.

- ❏ Probability can never be negative and more than one.

- ❏ The sum of the probabilities of all elementary events of an experiment is 1.

(i) an even number $(E_1) = 3/6 = \frac{1}{2}$

(ii) a multiple of 3 $(E_2) = 2/6 = \frac{1}{3}$

(iii) an even number or a multiple of 3 $(E_3) = \frac{4}{6} = \frac{2}{3}$

(iv) an even number and a multiple of 3 $(E_4) = 1/6$

(v) a number between 3 and 6. $(E_5) = \frac{2}{6} = \frac{1}{3}$

$\{2,3,4,6\}$

$\{6\}$

$\{4,5\}$

All possible Outcomes :-

$\{1,2,3,4,5,6\}$

#Q. Two unbiased coins are tossed simultaneously. Find the probability of getting

kam se kam 1 head

(i) two heads — E_1

zada se zada 1 head

(ii) one head — E_2

CBSE 2010, 13

(iii) at least one head — E_3

1, 2

(iv) at most one head — F_4

(v) no head E_5

0, 1

→ 'o' tail.

→ 'o' head.

All possible outcomes = {HH, HT, TH, TT}

(i) $E_1 = \{HH\}$

$P(E_1) = 1/4$

(iii) $E_3 = \{HH, HT, TH\}$

$P(E_3) = 3/4$

(v) $E_5 = \{TT\}$

$P(E_5) = 1/4$

(ii) $E_2 = \{HT, TH\}$

$P(E_2) = 2/4 = \frac{1}{2}$

(iv) $E_4 = \{HT, TH, TT\}$

$P(E_4) = 3/4$

#Q. Three unbiased coins are tossed together. Find the probability of getting:

(i) all heads - E_1 2,3   (ii) two heads - E_2 **CBSE 2015**

(iii) one head - E_3 (iv) at least two heads - E_4

(v) atmost 3 tails.   0,1,2,3

All possible Outcomes: { HHH, HHT, HTH, THH,

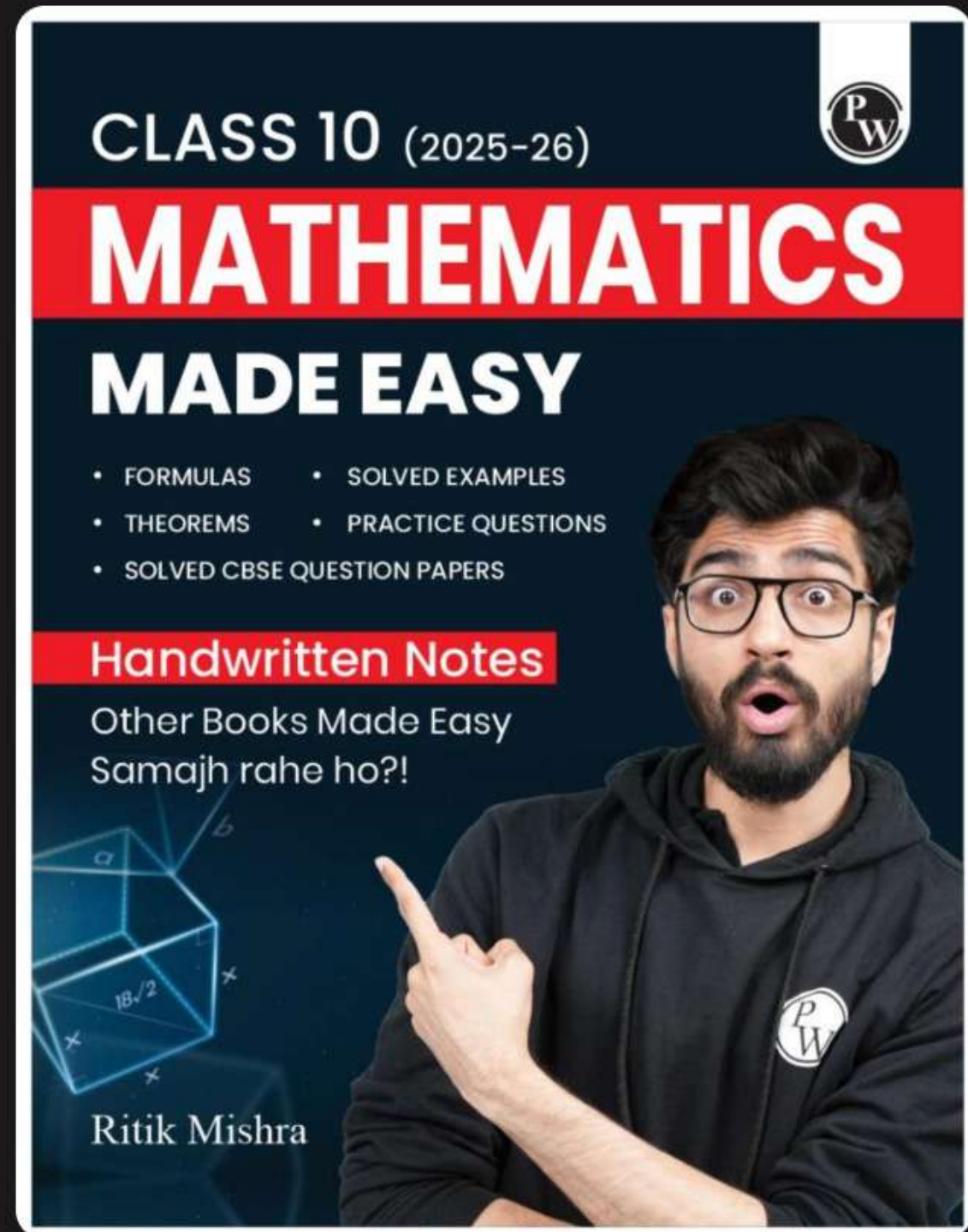TTT, TTH, THT, HTT }

(i) $E_1 = \{ HHH \}$

$P(E_1) = 1/8$

(ii) $E_2 = \{ HHT, HTH, THH \}$

$P(E_2) = 3/8$

(iii) $E_3 = \{ TTH, THT, HTT \}$

$P(E_3) = 3/8$

(iv) $E_4 = \{ HHH, HHT, HTH, THH \}$

$P(E_4) = 4/8 = \frac{1}{2}$

$\frac{8}{8} = 1$

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