🟦 Chapter 14: Probability

📌 What is Probability?

- **Probability** means the chance of something happening.
- Deals with **random experiments** like tossing a coin or rolling a die.

🎯 Important Definitions

- **Experiment**: Any activity with observable results (e.g., tossing a coin).
- **Outcome**: A possible result (e.g., Head or Tail).
- **Sample Space**: Set of all possible outcomes.

🧠 Theoretical (Classical) Probability

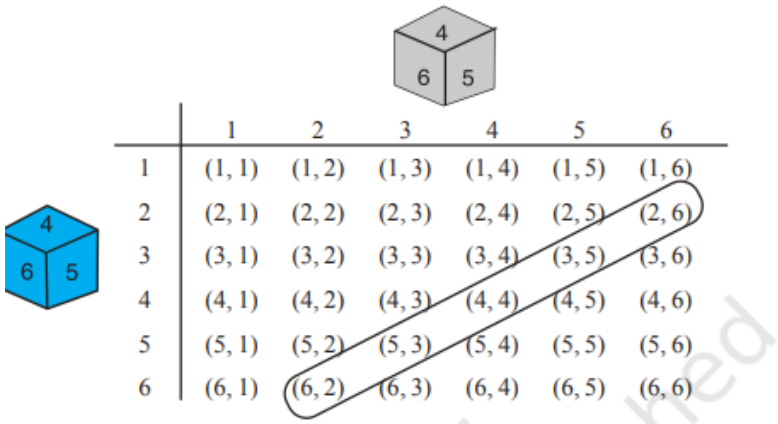
If all outcomes are **equally likely**, then:

$$P(E) = \frac{\text{Number of outcomes favourable to E}}{\text{Number of all possible outcomes of the experiment}},$$

📍 *Defined by Pierre Simon Laplace (1795)*

🎲 Examples of Equally Likely Outcomes

- Tossing a coin: Head or Tail
- Throwing a die: 1 to 6 (📍Fig. 14.3)



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

Fig. 14.3

- Picking a card from a deck (52 cards)

🟢 Key Properties

1. **0 ≤ P(E) ≤ 1**
2. **P(Sure event) = 1**
3. **P(Impossible event) = 0**
4. **P(Not E) = 1 – P(E)**
   → E and Not E are called **complementary events**

🧮 Real-Life Examples

✅ Drawing a card from 52 cards

- P(Ace) = 4/52 = 1/13
- P(Not Ace) = 48/52 = 12/13

✅ Coin Toss

- P(Head) = 1/2
- P(Tail) = 1/2
- P(Head or Tail) = 1

✅ Drawing a red ball from a bag

- If bag has 3 red, 2 white, 4 blue balls → Total = 9
- P(Red) = 3/9 = 1/3

✅ Two coins tossed

- Outcomes: (H, H), (H, T), (T, H), (T, T)
- P(At least one Head) = 3/4

📐 Geometry-based Probability

✅ Area-Based Probability (📍Fig. 14.1 & 14.2)

If outcomes are continuous:

P(E) = (Favourable area) / (Total area)

Example:

- Helicopter crash inside lake:
  P = 7.5 / 40.5 = 5/27

🗒️ Probability of Events from Dice or Cards

🎲 Two dice thrown

- Total outcomes = 6 × 6 = 36
- P(Sum is 8) = 5/36
- P(Sum is 13) = 0
- P(Sum ≤ 12) = 1

🃏 Cards

- P(Red Face Card) = 6/52
- P(King of red) = 2/52
- P(Spade) = 13/52 = 1/4

📊 Summary Box

Event Type	Probability
Impossible Event	0
Sure Event	1
Complementary Events	P(E) + P(Not E) = 1
Minimum Value of P(E)	0
Maximum Value of P(E)	1