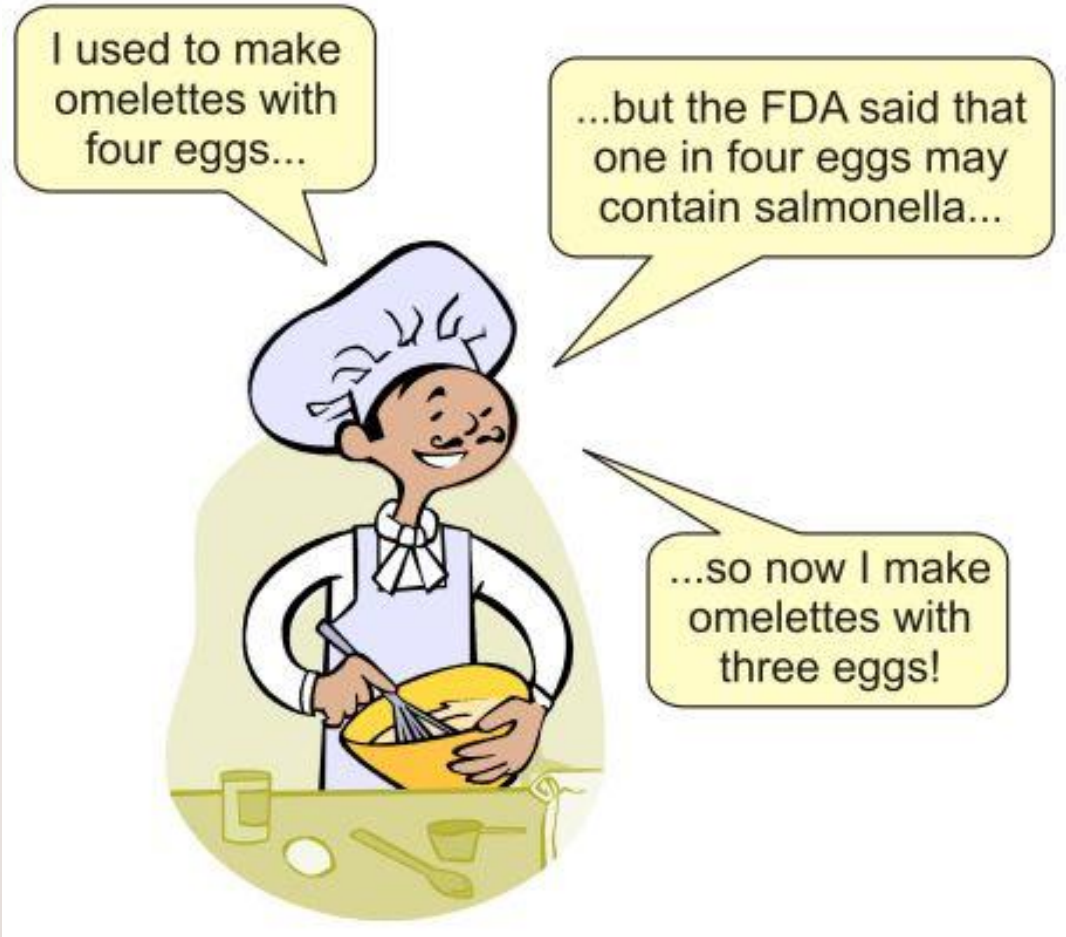
Probability

Mathematical measure of chance



Note: The gender ratio for the entire world population is 101 males to 100 females.

Learning Objectives

- Probability
- Conditional Probability

Types of Experiment

- **Deterministic** :

Result of an experiment is unique or certain.

- **Probabilistic** :

Result of the experiment is not unique or uncertain.

Various terms in defining probability

- **Random Experiment or Trail**:
  Experiment conducted any number of times under identical conditions and the result is not certain.

- **Events**:
  Outcomes of a random experiment.

- **Sample space**:
  Set of all possible outcomes.

- **Equally Likely**
  Equal chance of happening.

E.g.

A die is thrown is a trial, getting a number 1 or 2 or 3 or 4 or 5 or 6 is an event and {1,2,3,4,5,6} is the sample space.

Definitions of Probability

- $\boldsymbol{P(E)} = \frac{No: of\ favourable\ outcomes}{No: of\ all\ possible\ outcomes},\ 0 \leq P(E) \leq 1$

- $\boldsymbol{P(not\ E)} = 1 - P(E)$

- **Odds in favour**:

$$\frac{No: of\ favourable\ cases}{No: of\ unfavourable\ cases}$$

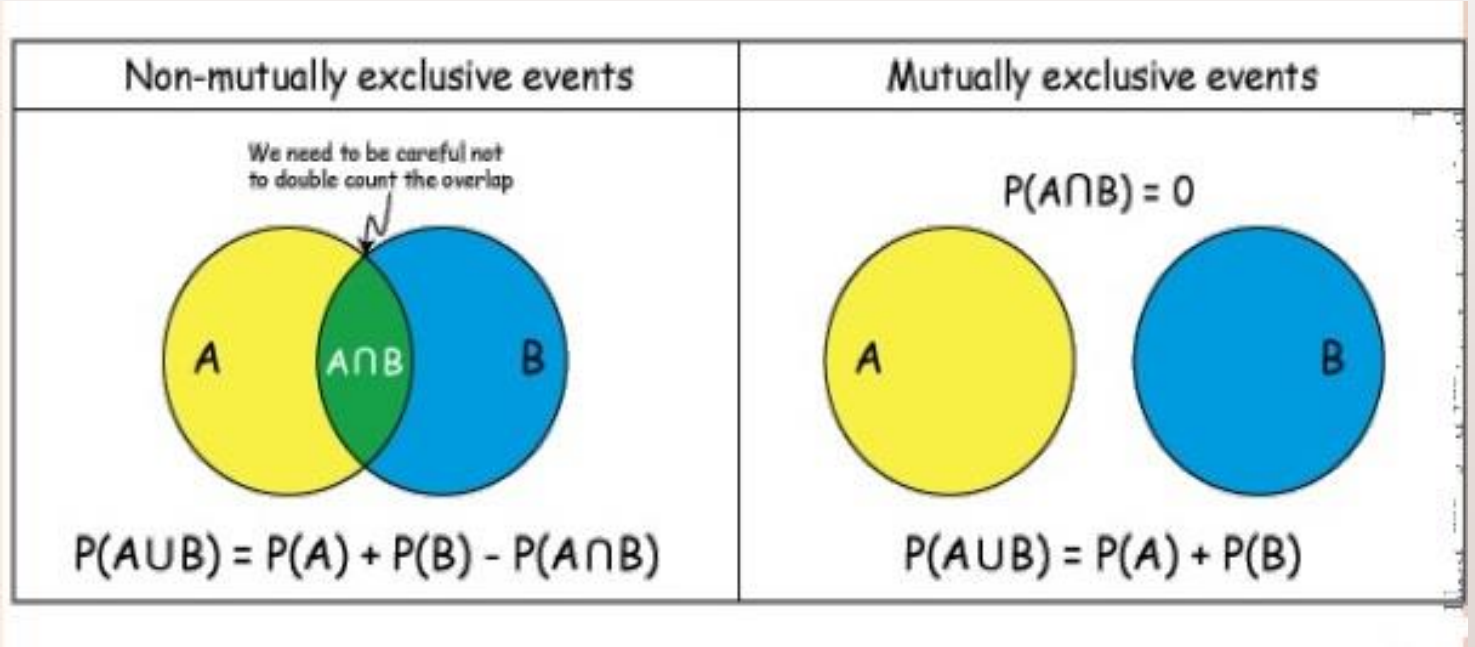
- **Odds in against**:

$$\frac{No: of\ unfavourable\ cases}{No: of\ favourable\ cases}$$

Various terms in defining probability

- **Mutually Exclusive or Disjoint:**
  One event prevents the occurrence of the other event
  (If A, then not B" and "If B, then not A)

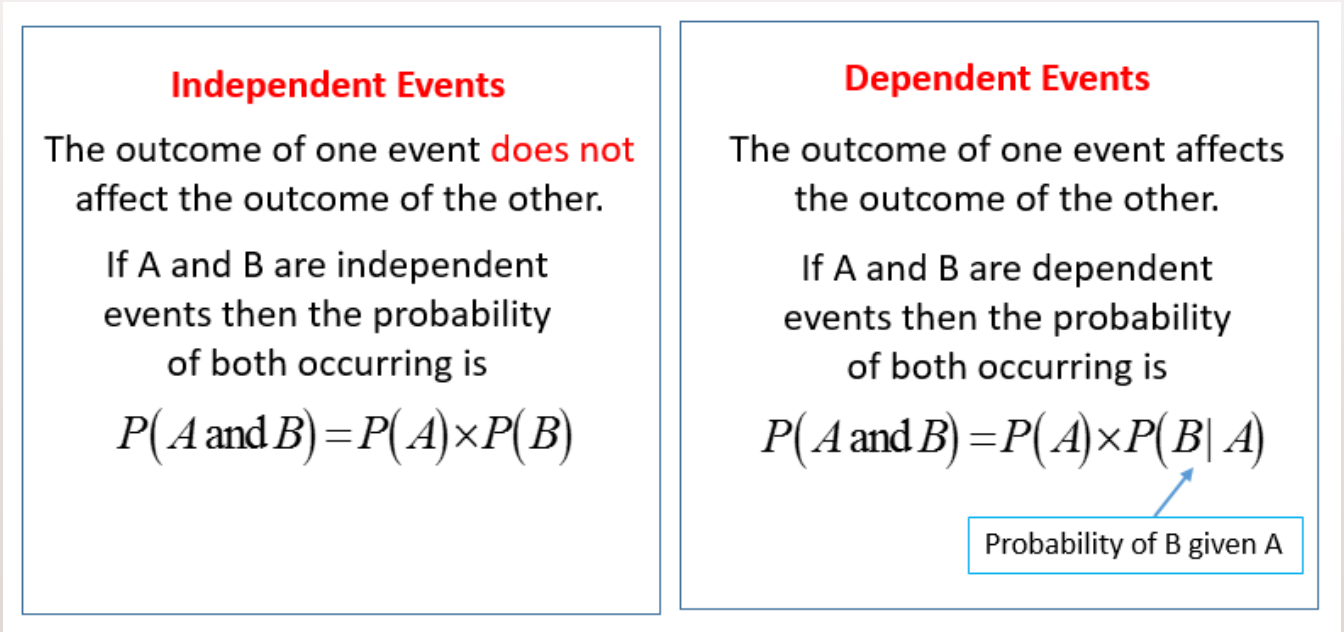
- Addition law:
  A & B are mutually exclusive, $\boldsymbol{P(A\ or\ B)} = P(A) + P(B)$



Various terms in defining probability

- **Independent Events**:
  Occurrence of one event does not affect the probability of the other event.

- Multiplication law:
  A & B are independent, $\boldsymbol{P(A\ and\ B)} = P(A) \times P(B)$



Types of questions

Questions based on:

- Coins
- Dice
- Cards
- Balls/Urns
- Chess board
- Arrangements, Selections
- Generic types

Example 1

Questions on Coins

- Three coins are tossed, probability of getting

(i) at least 2 heads Ans: 1/2

(ii) at most 2 heads Ans: 7/8

Example 2

Questions on Dice

- Two dice are rolled, probability of getting the sum a prime number?

A. $\frac{4}{9}$ B. $\frac{1}{3}$ C. $\frac{11}{36}$ D. $\frac{5}{12}$

Ans: Option: D

Example 3

Questions on Dice

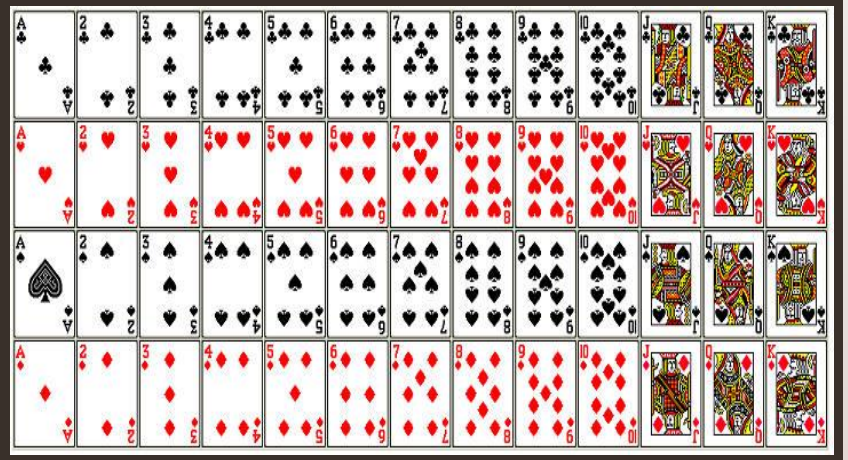
- Three dice are rolled, probability of getting the sum 11?

A. $\frac{21}{216}$ B. $\frac{18}{216}$ C. $\frac{1}{8}$ D. $\frac{1}{36}$

Ans: Option: C

Example 4

Questions on Cards



- If you pull 2 cards out of a deck, what is the probability that both are hearts?

A. $\frac{1}{17}$ B. $\frac{1}{16}$ C. $\frac{1}{15}$ D. $\frac{1}{4}$

Ans: Option: A

Example 5

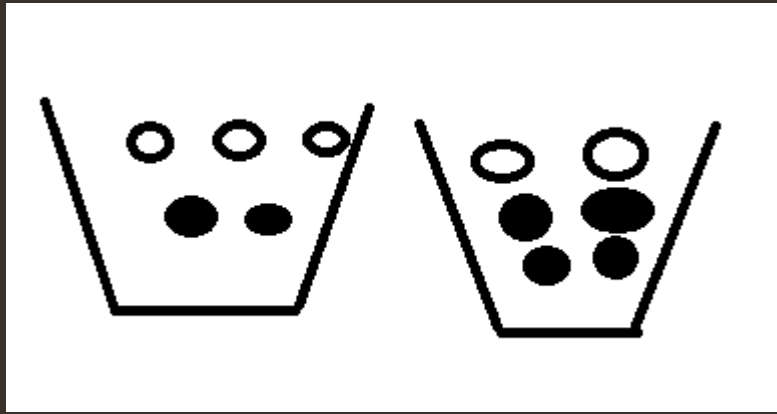
Questions on Cards

- Two cards are picked from a pack of cards in a random order without replacement, what is the probability that first card is a King, and the next card is a spade?

A. $\frac{4}{221}$ B. $\frac{1}{52}$ C. $\frac{4}{51}$ D. $\frac{1}{26}$

Ans: Option: B

Example 6



- A bag contains 3 white balls and 2 black balls. Another bag contains 2 white and 4 black balls. A bag and a ball are picked random. The probability that the ball will be white is?

A. $\frac{7}{11}$ B. $\frac{7}{30}$ C. $\frac{7}{15}$ D. $\frac{5}{11}$

Ans: Option: C

Example 7

Questions on Balls/Urns

- There are three similar boxes, containing

  I. 6 black and 4 white balls.

  II. 3 black and 7 white balls.

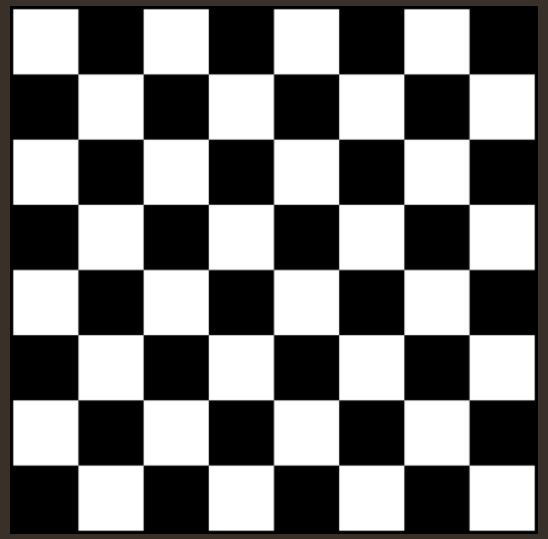
  III. 5 black and 5 white balls.

If you choose, one of the three boxes at random and from that particular box picks up a ball at random, and found that to be black, what is the probability that the ball picked up from the second box?

Ans: 3/14

Example 8

Questions on Chess board



- Two squares are chosen at random on a chess board. What is the probability that they have a side in common?

A. $\frac{1}{18}$ B. $\frac{64}{4032}$ C. $\frac{63}{164}$ D. $\frac{1}{9}$

Ans: Option: A

Example 9

Questions on arrangements

- Eight horses are entered in a race. You randomly predict a particular order for the horses to complete the race. What is the probability that your prediction is correct?

A. $\frac{1}{8}$ B. $\frac{1}{8!}$ C. $\frac{8}{8!}$ D. None of these

Ans: Option: B

Example 10

Questions on arrangements

- Four different objects 1, 2, 3, 4 are distributed at random in four places marked 1, 2, 3, 4. What is the probability that none of the objects occupy the place corresponding to its number?

A. $\frac{17}{24}$ B. $\frac{3}{8}$ C. $\frac{1}{2}$ D. $\frac{5}{8}$

Ans: Option: B

Example 11

Questions on arrangements

- How many ways 11 players including Sachin, Sourav, Virat and MS can be arranged for a batting order such that Sachin should always bat ahead of Sourav, Sourav should always bat ahead of Virat and Virat should always bat ahead of MS, find its probability?

Ans: 11P7/11!

Example 12

Generic type

- India plays two matches each with Pakistan and Australia. In any match the probabilities of India getting 0, 1 and 2 points with probabilities are 0.45, 0.05 and 0.50 respectively. Assume that the outcomes are independent, the probability of India getting at least 7 points is

A. 0.04 B. 0.0375 C. 0.0875 D. 0.0650

Ans: Option: C

Thank you

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