14 Probability

Fastrack Revision

- **Experiment:** An operation which can produce some well-defined outcomes is called an experiment.
- **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.
- **Outcome:** A possible result of a random experiment is called its outcome.
- **Sample Space:** The collection of all possible outcomes of an experiment is called the sample space of the experiment.
- **Event:** The collection of all or some of the possible outcomes is called an event.
- **Elementary Event:** An event having only one outcome of the random experiment is called an elementary event.
- **Occurrence of an Event:** An event E associated to a random experiment is said to occur, if any one of the elementary events associated to the event E is an outcome.
- **Equally Likely Events:** A given number of events are said to be equally likely if none of them is expected to occur in preference to the other.
- **Complementary Event:** Let E be an event in a sample space, the complement of E is the collection of all outcomes of the space other than the outcomes in E and it is denoted by $\bar{E}$.
- **Favourable Outcomes:** The outcomes which ensure the occurrence of an event are called favourable outcomes of the event.
- **Probability:** Probability of occurrence of an event,

$$P(E) = \frac{\text{Number of favourable outcomes (E)}}{\text{Total number of possible outcomes}}$$

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

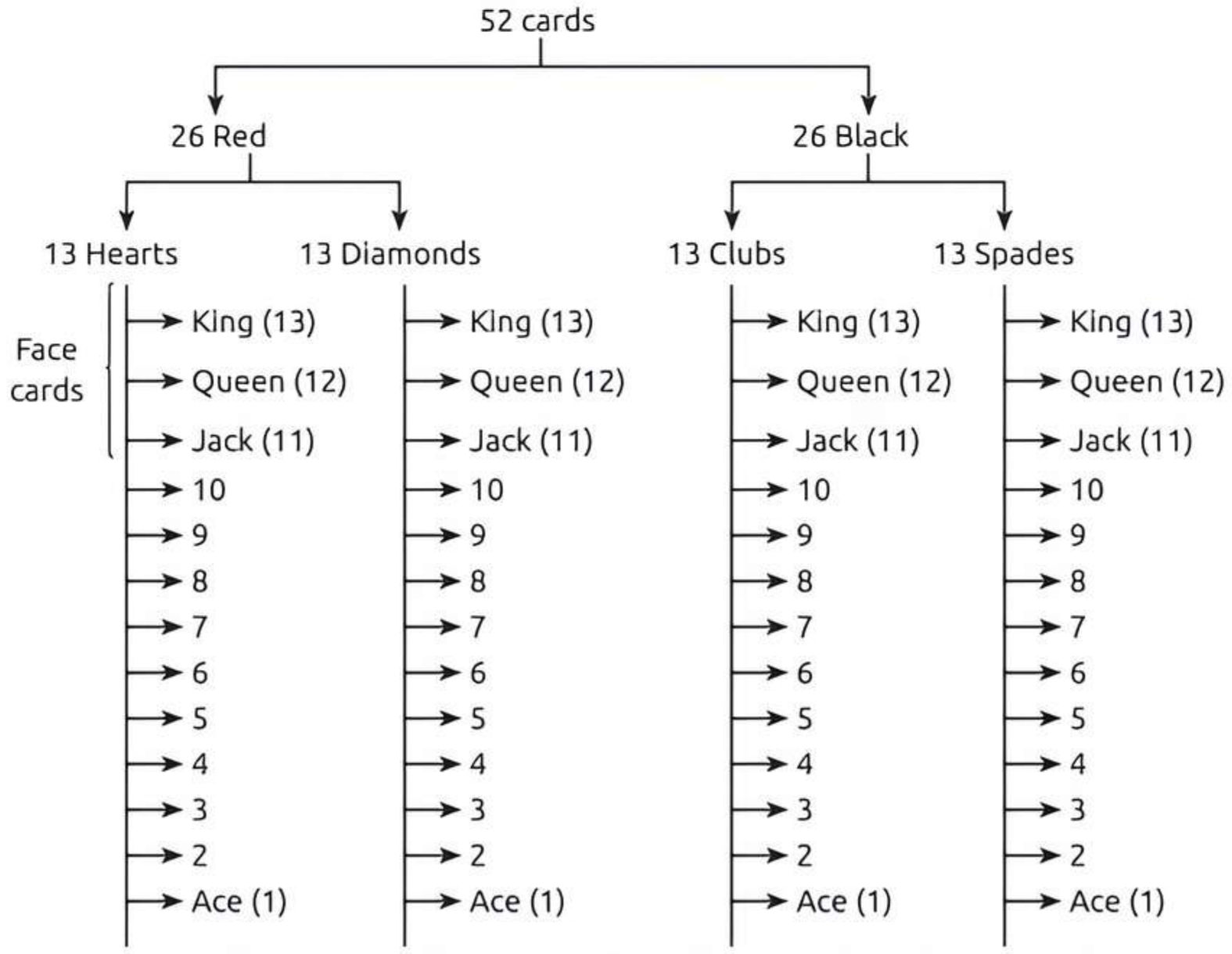
Or

$P(\text{not } E) = 1 - P(E)$ or $P(\bar{E}) = 1 - P(E)$.

Knowledge BOOSTER

1. *Probability of a sure or certain event is* 1.
2. *Probability of an impossible event is* 0.
3. $0 \le P(E) \le 1$
4. *The sum of the probabilities of all the elementary events of an experiment is* 1.
5. *If we want to get a result in percentage, multiply the probability value by* 100.
6. *A* ***coin*** *has two sides—Head (H) and Tail (T).*
7. *A* ***die*** *has six faces marked as* 1,2,3,4,5 *and* 6.

Deck of Playing Cards



- Jacks, queens and kings are all considered face cards. Thus, there are three face cards for each suit and a total of $3 \times 4 = 12$ face cards in the deck.

Practice Exercise

Multiple Choice Questions

Q 1. Which of the following numbers cannot be the probability of an event? *[CBSE 2023]*

a. 0.5 b. 5% c. $\frac{1}{0.5}$ d. $\frac{0.5}{14}$

Q 2. A dice is thrown once. Find the probability of getting a number less than 7. *[CBSE 2023]*

a. $\frac{5}{6}$ b. 1

c. $\frac{1}{6}$ d. 0

Q 3. For an event E, $P(E) + P(\overline{E}) = x$, then the value $x^3 - 3$ is: *[CBSE 2021 Term-I]*

a. –2 b. 2 c. 1 d. –1

Q 4. The probability of getting a bad egg in a lot of 400 is 0.035. The number of bad eggs in the lot is: *[NCERT EXEMPLAR]*

a. 7 b. 14 c. 21 d. 28

Q 5. When a die is thrown, the probability of getting an even number less than 4 is: *[CBSE SQP 2023-24]*

a. $\frac{1}{4}$ b. 0 c. $\frac{1}{2}$ d. $\frac{1}{6}$

Q 6. A die is thrown once. The probability of getting an odd prime number is: *[CBSE 2023]*

a. $\frac{1}{2}$ b. $\frac{1}{6}$

c. $\frac{1}{3}$ d. $\frac{2}{3}$

Q 7. A die is rolled once. The probability that a composite number comes up, is: *[CBSE 2023]*

a. $\frac{1}{2}$ b. $\frac{2}{3}$ c. $\frac{1}{3}$ d. 0

Q 8. The probability of getting an even number or a multiple of 3 if an unbiased die is thrown, is:

a. $\frac{1}{3}$ b. $\frac{1}{6}$

c. $\frac{2}{3}$ d. None of these

Q 9. A bag contains 5 pink, 8 blue and 7 yellow balls. One ball is drawn at random from the bag. What is the probability of getting neither a blue nor a pink ball? *[CBSE 2023]*

a. $\frac{1}{4}$ b. $\frac{2}{5}$

c. $\frac{7}{20}$ d. $\frac{13}{20}$

Q 10. A card is drawn at random from a well-shuffled deck of 52 cards. The probability of getting a red card is: *[CBSE 2023]*

a. $\frac{1}{26}$ b. $\frac{1}{13}$ c. $\frac{1}{4}$ d. $\frac{1}{2}$

Q 11. A card is drawn at random from a well-shuffled deck of 52 playing cards. The probability of getting an ace of spade is: *[CBSE 2023]*

a. $\frac{1}{13}$ b. $\frac{3}{52}$ c. $\frac{1}{26}$ d. $\frac{1}{52}$

Q 12. A card is drawn at random from a well-shuffled deck of 52 playing cards. The probability that it is a red king, is: *[CBSE 2023]*

a. $\frac{1}{13}$ b. $\frac{1}{52}$

c. $\frac{1}{26}$ d. $\frac{2}{13}$

Q 13. A card is drawn at random from a well shuffled deck of 52 playing cards. The probability of getting a face card is: *[CBSE 2023]*

a. $\frac{1}{2}$ b. $\frac{3}{13}$ c. $\frac{4}{13}$ d. $\frac{1}{13}$

Q 14. A card is drawn at random from a well shuffled pack of 52 cards. The probability that the card drawn is not an ace is: *[CBSE 2023]*

a. $\frac{1}{13}$ b. $\frac{9}{13}$

c. $\frac{4}{13}$ d. $\frac{12}{13}$

Q 15. A card is drawn from a well shuffled deck of cards. What is the probability that the card drawn is neither a king nor a queen? *[CBSE SQP 2021 Term-I]*

a. 11/13 b. 12/13

c. 11/26 d. 11/52

Q 16. 2 cards of hearts and 4 cards of spades are missing from a pack of 52 cards. What is the probability of getting a black card from the remaining pack? *[CBSE SQP 2023-24]*

a. $\frac{22}{52}$ b. $\frac{22}{46}$

c. $\frac{24}{52}$ d. $\frac{24}{46}$

Q 17. Two fair coins are tossed. What is the probability of getting at most one head? *[CBSE SQP 2021 Term-I]*

a. 3/4 b. 1/4 c. 1/2 d. 3/8

Q 18. Two coins are tossed together. The probability of getting atmost two heads, is: *[CBSE 2023]*

a. $\frac{1}{2}$ b. $\frac{1}{4}$ c. $\frac{3}{4}$ d. 1

Q 19. Cards marked with number 2, 4, 6, 8, 10, ..., 50 are placed in a bag and mixed thoroughly. One cards is then drawn. What is the probability that the card is marked with a prime number?

a. $\frac{1}{25}$ b. $\frac{1}{50}$ c. $\frac{1}{100}$ d. $\frac{1}{10}$

Q 20. A bag contains 100 cards numbered 1 to 100. A card is drawn at random from the bag. What is the probability that the number on the card is a perfect cube? *[CBSE 2023]*

a. $\frac{1}{20}$ b. $\frac{3}{50}$ c. $\frac{1}{25}$ d. $\frac{7}{100}$

Q 21. One ticket is drawn at random from a bag containing tickets numbered 1 to 40. The probability that the selected ticket has a number, which is a multiple of 5 is: *[NCERT EXEMPLAR]*

a. $\frac{1}{5}$ b. $\frac{3}{5}$ c. $\frac{4}{5}$ d. $\frac{1}{3}$

Q 22. If a letter of English alphabet is chosen at random, then the probability that the letter is a consonant is:

a. $\frac{5}{26}$ b. $\frac{21}{26}$ c. $\frac{10}{26}$ d. $\frac{4}{26}$

Q 23. A letter of English alphabets is chosen at random. What is the probability that it is a letter of the word 'MATHEMATICS'? *[CBSE SQP 2021 Term-I]*

a. 4/13 b. 9/26 c. 5/13 d. 11/26

Q 24. A bag contains 5 red balls and *n* green balls. If the probability of drawing a green ball is three times that of a red ball, then the value of *n* is: *[CBSE 2023]*

a. 18 b. 15 c. 10 d. 20

Q 25. The probability of a non-leap year having 53 Monday is:

a. $\frac{2}{7}$ b. $\frac{1}{7}$ c. $\frac{5}{7}$ d. $\frac{6}{7}$

Assertion & Reason Type Questions

Directions (Q. Nos. 26-30): *In the following questions, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option:*

a. Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A)
b. Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A)
c. Assertion (A) is true but Reason (R) is false
d. Assertion (A) is false but Reason (R) is true

Q 26. Assertion (A): When two coins are tossed together then the probability of getting no tail is $\frac{1}{4}$.

Reason (R): The probability of getting a head (*i.e.*, no tail) in one toss of a coin is $\frac{1}{2}$.

Q 27. Assertion (A) : The probability that a leap year has 53 Sundays is $\frac{2}{7}$.

Reason (R): The probability that a non-leap year has 53 Sundays is $\frac{5}{7}$. *[CBSE 2023]*

Q 28. Assertion (A): Two players Sania and Deepika play a tennis match. If the probability of Sania winning the match is 0.68, then the probability of Deepika winning the match is 0.32.

Reason (R): The sum of the probability of two complementary events is 1.

Q 29. Assertion (A): Cards numbered 5 to 102 are placed in a box. If a card is selected at random from the box, then the probability that the card selected has a number which is a perfect square, is $\frac{4}{49}$.

Reason (R): Probability of an event E is a number P(E) such that $0 \le P(E) \le 1$.

Q 30. Assertion (A): The probability of getting a prime number, when a die is thrown once, is $\frac{2}{3}$.

Reason (R): On the faces of a die, prime numbers are 2, 3, 5. *[CBSE 2023]*

Fill in the Blanks Type Questions

Q 31. Probability of an event cannot be ..... (Negative/positive).

Q 32. The outcomes which ensure the occurrence of an event are called ..... outcomes.

Q 33. The set of all possible outcomes of a random experiment is a ..... space.

Q 34. In tossing a die, the probability of getting a number 8 is .....

Q 35. If a bag contains 5 red and 4 black balls and a ball is drawn at random from the bag, the probability of getting a black ball is .....

True/False Type Questions

Q 36. The probability of an event is greater than or equal to 0 and less than or equal to 1. *[NCERT EXERCISE]*

Q 37. If P(E) = 0.05, then the probability of 'not E' is 0.85.

Q 38. The probability of getting any day in a week is 1.

Q 39. The probability of getting a prime number if a die is thrown once, is 1/2.

Q 40. Two different coins are tossed simultaneously. The probability of getting at least one head is $\frac{3}{4}$.

Solutions

1. (c) $\frac{1}{0.5} = \frac{10}{5} = 2$, can not be the value of probability, because probability of any event greater than equal to 0 and less than equal to 1.

2. (b) Possible outcomes = 1, 2, 3, 4, 5, 6
Total number of possible outcomes = 6
Favourable outcomes = numbers less than 7 = 1, 2, 3, 4, 5, 6
Total number of favourable outcomes = 6
So, probability of getting a number less than 7 $= \frac{6}{6} = 1$

3. (a)

TR!CK

$$P(E) + P(\overline{E}) = 1$$

Given $P(E) + P(\overline{E}) = x$
$\therefore$ $x = 1$
Now, $x^3 - 3 = (1)^3 - 3$
$= 1 - 3 = -2$

4. (b) Here, total number of eggs = 400
Probability of getting a bad egg = 0.035

$$\Rightarrow \frac{\text{Number of bad eggs}}{\text{Total number of eggs}} = 0.035$$

$$\Rightarrow \frac{\text{Number of bad eggs}}{400} = 0.035$$

Number of bad eggs = $0.035 \times 400 = 14$

5. (d) Possible outcomes = 1, 2, 3, 4, 5, 6
Total number of possible outcomes = 6
Favourable outcomes = even numbers less than 4.
= 2.
Total number of favourable outcomes = 1.
So, probability of getting an even number less than 4 $= \frac{1}{6}$.

6. (c) Possible outcomes = 1, 2, 3, 4, 5 6
Total number of possible outcomes = 6
Favourable outcomes = odd prime numbers
= 3, 5
Total number of favourable outcomes = 2
So, probability of getting an odd prime number $= \frac{2}{6} = \frac{1}{3}$.

7. (c) Possible outcomes = 1, 2, 3, 4, 5, 6
Total number of possible outcomes = 6
Favourable outcomes = Composite numbers = 4, 6
Total number of favourable outcomes = 2
So, probability of getting a composite number $= \frac{2}{6} = \frac{1}{3}$.

8. (c) Total number of sample outcomes = 6
and favourable outcomes = getting an even number or a multiple of 3 = {2, 4, 6} or {3, 6} = {2, 3, 4, 6}
Total number of favourable outcomes = 4

$\therefore$ Required probability $= \frac{4}{6} = \frac{2}{3}$

9. (c) Number of favourable outcomes = 7 as there are 7 yellow balls because a ball getting neither a blue nor a pink.
Number of all possible outcomes
= 5 pink + 8 blue + 7 yellow = 20

$\therefore$ Required probability $= \frac{7}{20}$

10. (d) Number of possible outcomes = 52
Total number of favourable outcomes = Number of red cards in a deck of 52 playing cards = 26
So, probability of getting a red card $= \frac{26}{52} = \frac{1}{2}$.

11. (d) Number of possible outcomes = 52
Total number of favourable outcomes = 13 spade cards in a deck of 52 playing cards, in which only one ace card of spade.
= 1
So, probability of getting an ace of spade $= \frac{1}{52}$

12. (c) Number of possible outcomes = 52
Total number of favourable outcomes = There are 26 red cards in which only 2 kings of red colour.
= 2
So, probability getting a red king $= \frac{2}{52} = \frac{1}{26}$.

13. (b) Number of favourable outcomes
= No. of face cards in a deck of 52 playing cards
= 12
Number of all possible outcomes = 52

$\therefore$ Required probability $= \frac{12}{52} = \frac{3}{13}$

14. (d) Favourable outcomes = Number of ace cards = 4
Number of all possible outcomes = 52

P (getting an ace card) $= \frac{4}{52} = \frac{1}{13}$

$\therefore$ Required probability = 1 – P (getting an ace card)

$$= 1 - \frac{1}{13} = \frac{12}{13}$$

15. (a) Number of cards in a well shuffled deck = 52
In a well shuffled deck of cards, there are 4 kings and 4 queens.
Total number of possible outcomes = 52
and total number of favourable outcomes (neither a king nor a queen) = 52 – 4 – 4 = 44

$\therefore$ Required probability $= \frac{44}{52} = \frac{11}{13}$

16. (b) Number of cards in a well shuffled deck = 52
In a well shuffled deck of cards, there are 13 hearts and 13 spades cards.
Out of these cards, 2 cards of hearts and 4 cards of spades are missing.

$\therefore$ Total number of possible outcomes
$= 52 - 2 - 4 = 52 - 6 = 46$
Now, total no. of black cards in a well shuffled deck of cards $= (13 + 13) - 4 = 26 - 4 = 22$
$\therefore$ Total number of favourable outcomes $= 22$

So, required probability $= \frac{22}{46} = \frac{11}{23}$

COMMON ERROR

Mostly, students commit the error in finding total outcomes of the event.

17. (a) Possible outcomes are (HH), (HT), (TH), (TT)
$\therefore$ Total number of possible outcomes $= 4$
Favourable outcomes (at most one head) are (HT), (TH) and (TT)
$\therefore$ Total number of favourable outcomes $= 3$

So, P(getting at most one head) $= \frac{3}{4}$

18. (d) Possible outcomes = HH, HT, TH, TT
$\therefore$ Total number of possible outcomes $= 4$
Favourable outcomes = Atmost two heads
= HH, HT, TH, TT
$\therefore$ Total number of favourable outcomes $= 4$.

So, probability of getting atmost two heads $= \frac{4}{4} = 1$

19. (a) Number of favourable outcomes = 1, as only 2 is the prime number.
Number of all possible outcomes = 25 (No. of cards)

$\therefore$ Required probability $= \frac{1}{25}$

20. (c) Total number of possible outcomes = No. of cards
$= 100$
Favourable outcomes = Perfect cube numbers $= \{1, 8, 27, 64\}$
$\therefore$ Total number of favourable outcomes $= 4$

So, the required probability $= \frac{4}{100} = \frac{1}{25}$

21. (a) Total number of outcomes = 40
Multiples of 5 from 1 to 40 are {5, 10, 15, 20, 25, 30, 35, 40}
So, number of favourable number of outcomes = 8

$\therefore$ Required probability $= \frac{8}{40} = \frac{1}{5}$

22. (b)

TiP

In English alphabets, there are 21 consonants and 5 vowels.

Number of letters in English alphabet = 26
Number of consonants = 21
So, favourable number of outcomes = 21

$\therefore$ Required probability $= \frac{21}{26}$

23. (a) Possible outcomes (English Alphabets)
$= \{A, B, \ldots\ldots, Y, Z\}$
Number of possible outcomes = 26
Favourable outcomes (a letter of the word 'MATHEMATICS') $= \{M, A, T, H, E, I, C, S\}$
Number of favourable outcomes = 8

$\therefore$ Required probability $= \frac{8}{26} = \frac{4}{13}$

24. (b) Total number of balls $= 5 + n$
So, the possible number of outcomes $= 5 + n$

Now, P (drawing a green ball) $= \frac{n}{5+n}$

Also, P(drawing a red ball) $= \frac{n}{5+n}$

According to the question,

$$\frac{n}{5+n} = 3\left(\frac{5}{5+n}\right) \Rightarrow n = 15$$

25. (b) Number of days in a non-leap year = 365
Number of complete weeks = 52
Number of days left = 1
Probability of this day being a Monday
= Probability of 53 Mondays $= \frac{1}{7}$

COMMON ERRORS

- *Some students confuse between ordinary year and leap year.*
- *A ordinary year has 365 days.*
- *A leap year has 366 days.*
- *Some students take 365 days in a leap year and get a wrong answer.*

26. (b) **Assertion (A):** Total possible outcomes $= 2 \times 2 = 4$
Number of favourable outcomes of getting no tail $= 1$ {*i.e.*, (H, H)}

$\therefore$ Required probability $= \frac{1}{4}$

So, Assertion (A) is true.
Reason (R): Total possible outcomes = 2
Number of favourable outcomes $= 1$ {*i.e.*, H}

$\therefore$ Required probability $= \frac{1}{2}$

So, Reason (R) is true.
Hence, both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).

27. (c) **Assertion (A):** Number of days in a leap year = 366
Number of complete weeks = 52
Number of days left = 2
$\therefore$ Probability of these days being Sunday
= Probability of 53 Sundays $= \frac{2}{7}$

So, Assertion (A) is true.
Reason (R): Number of days in a non-leap year = 365
Number of complete weeks = 52
Number of days left = 1

$\therefore$ Probability of this day being a Sunday = Probability of 53 Sundays $= \frac{1}{7}$

So, Reason (R) is false.

Hence, Assertion (A) is true but Reason (R) is false.

28. (a) **Assertion (A):** Let E be the event 'Sanla win the match'.

So, probability of Sanla winning the match = P(E) = 0.68

$\because$ $P(E) + P(\overline{E}) = 1$

$\therefore$ Probability of Deepika winning the match

$= P(\overline{E}) = 1 - 0.68 = 0.32$

So, Assertion (A) is true.

Reason (R): It is true to say that sum of probability of two complementary events is 1.

Hence, both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

29. (a) **Assertion (A):** Total number of cards $= 102 - 5 + 1 = 98$

So, total number of possible outcomes = 98

Let E be the event of selecting a card with square number.

So, favourable outcomes to E are

{9, 16, 25, 36, 49, 64, 81, 100} *i.e.*, 8

$\therefore$ $P(E) = \frac{8}{98} = \frac{4}{49}$

So, Assertion (A) is true.

Reason (R): It is a true statement.

Hence, both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

30. (d) **Assertion (A):** Possible outcomes = 1, 2, 3, 4, 5, 6

$\therefore$ Total number of possible outcomes = 6

Favourable outcomes = prime numbers on a die

= 2, 3, 5

$\therefore$ Total number of a favourable outcomes = 3

So, probability of getting a prime number $= \frac{3}{6} = \frac{1}{2}$

$\therefore$ Assertion (A) is false.

Reason (R) : It is a true statement

Hence, Assertion (A) is false but Reason (R) is true.

31. Negative

32. Favourable

33. Sample

34. In tossing a die, there are six numbers (*i.e.*, 1, 2, 3, 4, 5, 6).

Total possible number of outcomes = 6

Favourable number of outcomes = 0

($\because$ Number 8 is not exist in a die)

$\therefore$ Probability of getting a number 8 $= \frac{0}{6} = 0$

35. Total number of balls in a boy = 4 + 5 = 9 balls.

Number of favourable outcomes

= number of a black ball = 4

$\therefore$ The probability of getting a black ball

$= \frac{\text{Number of favourable outcomes}}{\text{Total number of outcomes}} = \frac{4}{9}$

36. True

37.

TR ! CK

P(E) + P(not E) = 1

Given, $P(E) = 0.05$

$\because$ $P(E) + P(\text{not } E) = 1$

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

$= 1 - 0.05$

$= 0.95$

Hence, given statement is false.

38. Total number of days in a week = 7

Number of favourable days in a week = 7

$\therefore$ Probability of getting any day in a week $= \frac{7}{7} = 1$

Hence, it is a true statement.

39. Total number of possible outcomes = 6

Number of favourable outcome of getting a prime number = 3 (*i.e.* 2, 3, 5)

$\therefore$ The probability of getting a prime number

$= \frac{\text{Number of favourable outcomes}}{\text{Total number of possible outcomes}} = \frac{3}{6} = \frac{1}{2}$

Hence, given statement is true.

40. Total number of possible outcomes

= 4 *i.e.*, (T,T), (H, T), (T, H), (H, H)

Number of favourable outcomes of getting at least one head = 3

(*i.e.*, (H, T), (T, H), (H, H))

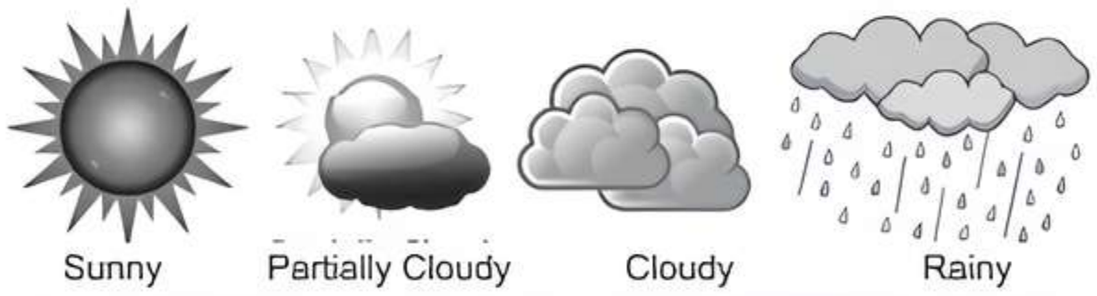
$\therefore$ Required probability $= \frac{3}{4}$

Hence, given statement is true.

Case Study Based Questions

Case Study 1

In the month of May, the weather forecast department gives the prediction of weather for the month of June. The given table shows the probabilities of forecast of different days:



Days	Sunny	Cloudy	Partiallly cloudy	Rainy
Probability	$\frac{1}{2}$	x	$\frac{1}{5}$	y

Based on the above information, solve the following questions:

Q 1. The number of sunny days in June is:

a. 5 b. 10 c. 15 d. 20

Q 2. If the number of cloudy days in June is 5, then x =

a. $\frac{1}{4}$ b. $\frac{1}{6}$ c. $\frac{1}{8}$ d. $\frac{1}{10}$

Q 3. The probability that the day is not rainy, is:

a. $\frac{13}{15}$ b. $\frac{11}{15}$

c. $\frac{1}{15}$ d. None of these

Q 4. If the sum of x and y is $\frac{3}{10}$, then the number of rainy days in June, is:

a. 1 b. 2 c. 3 d. 4

Q 5. Find the number of partially cloudy days:

a. 2 b. 4 c. 6 d. 8

Solutions

1. Total number of days in June = 30
Number of sunny days = P(sunny day) × 30
$= \frac{1}{2} \times 30 = 15$

So, option (c) is correct.

2. Number of cloudy days in June = 5

$\therefore \quad x = \frac{5}{30} = \frac{1}{6}$

So, option (b) is correct.

3. Required probability

$= \frac{1}{2} + \frac{1}{6} + \frac{1}{5} = \frac{15+5+6}{30} = \frac{26}{30} = \frac{13}{15}$

So, option (a) is correct.

4. We have, $x + y = \frac{3}{10} \Rightarrow y = \frac{3}{10} - \frac{1}{6}$

$= \frac{9-5}{30} = \frac{4}{30} = \frac{2}{15}$

So, number of rainy days $= \frac{2}{15} \times 30 = 4$

So, option (d) is correct.

5. Number of partially cloudy days

= P(partially cloudy days) $\times 30 = \frac{1}{5} \times 30 = 6$

So, option (c) is correct.

Case Study 2

Two friends Soniya and Deepak have some saving in their piggy bank. They decided to count the total coins they both had. After counting they find they have fifty ₹1 coins, forty eight ₹2 coins, thirty six ₹5 coins, twenty eight ₹10 coins and eight ₹20 coins. Now, they said to Annu, their another friend, to choose a coin randomly. Find the probability that the coin chosen is:

Based on the given information, solve the following questions:

Q 1. ₹5 coin:

a. $\frac{17}{55}$ b. $\frac{36}{85}$ c. $\frac{18}{85}$ d. $\frac{1}{5}$

Q 2. ₹20 coin:

a. $\frac{13}{85}$ b. $\frac{4}{85}$ c. $\frac{3}{85}$ d. $\frac{4}{15}$

Q 3. Not a ₹10 coin:

a. $\frac{15}{31}$ b. $\frac{36}{85}$ c. $\frac{1}{5}$ d. $\frac{71}{85}$

Q 4. Of denomination of atleast ₹10:

a. $\frac{18}{85}$ b. $\frac{36}{85}$ c. $\frac{1}{17}$ d. $\frac{16}{85}$

Q 5. Of denomination of atmost ₹5:

a. $\frac{67}{85}$ b. $\frac{36}{85}$ c. $\frac{4}{85}$ d. $\frac{18}{85}$

Solutions

1. Total number of coins = 50 + 48 + 36 + 28 + 8
= 170

Number of ₹5 coins = 36

∴ Required probability $= \frac{36}{170} = \frac{18}{85}$

2. Number of ₹20 coins = 8

∴ Required probability $= \frac{8}{170} = \frac{4}{85}$

3. Number of ₹10 coins = 28

Required (coin is of ₹10) $= \frac{28}{170}$

∴ Required probability = 1 – P(coin is of ₹10)

$= 1 - \frac{28}{170} = \frac{142}{170} = \frac{71}{85}$

4. Total number of coins of ₹10 and ₹20

∴ Required probability $= \frac{36}{170} = \frac{18}{85}$

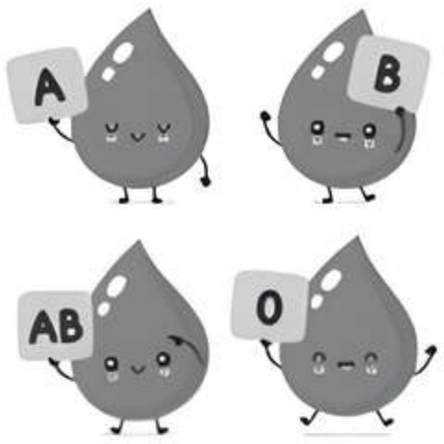
5. Total number of coins of ₹1, ₹2 and ₹5
= 50 + 48 + 36 = 134

∴ Required probability $= \frac{134}{170} = \frac{67}{85}$

Case Study 3

Blood group describes the type of blood a person has. It is a classification of blood on the presence of absence of inherited antigenic substances on the surface of red blood cells. Blood types predict whether a serious reaction will occur in a blood transfusion.

In a sample of 50 people, 21 had type O blood, 22 had type A, 5 had type B and rest had type AB blood group. *[CBSE 2023]*



Based on the given information, solve the following questions:

Q 1. What is the probability that a person chosen at random had type O blood?

Q 2. What is the probability that a person chosen at random had type AB blood group?

Q 3. What is the probability that a person chosen at random had neither type A nor type B blood group?

Or

What is the probability that person chosen at random had either type A or type B or type O blood group?

Solutions

Number of people = 50
Number of people had type O blood = 21
Number of people had type A blood = 22
Number of people had type B blood = 5
∴ Number of people had type AB blood
= 50 – (21 + 22 + 5) = 50 – 48 = 2

1. Total number of possible outcomes = 50
No. of favourable outcomes = No. of people had type O blood = 21.
∴ Probability that a person chosen at random had type O blood $= \frac{21}{50}$.

2. Total number of possible outcomes = 50
No. of favourable outcomes = No. of people had type AB blood = 2.
∴ Probability that a person chosen at random had type AB blood $= \frac{2}{50} = \frac{1}{25}$

3. Total number of possible outcomes = 50
No. of favourable outcomes
= No. of people which have neither type A nor type B blood group.
= 50 – (22 + 5) = 50 – 27 = 23.
∴ Probability that a person chosen at random had neither type A nor type B blood group $= \frac{23}{50}$.

Or

Total number of possible outcomes = 50
No. of favourable outcomes = No. of people which have either type A or type B or type O blood group.
= 22 + 5 + 21 = 48
∴ Probability that person chosen at random had either type A or type B or type O blood group $= \frac{48}{50} = \frac{24}{25}$.

Case Study 4

Sunny goes to a store to purchase juice cartons for his shop. The store has 80 cartons of litchi juice, 90 cartons of pineapple juice, 38 cartons of mango juice and 42 cartons of banana juice. If Sunny chooses a carton at random.

Based on the above information, solve the following questions:

Q 1. Find the probability that the selected carton is of pineapple juice.

Q 2. What is the probability that selecting carton is of banana juice?

Q 3. Sunny buys 4 cartons of pineapple juice, 3 cartons of litchi juice and 3 cartons of banana juice. A customer comes to Sunny's shop and picks a tetrapack of juice at random. Find the probability that the customer picks a banana juice, if each carton has 10 tetrapacks of juice.

Or

If the storekeeper bought 14 more cartons of pineapple juice, then find the probability of selecting a tetrapack of pineapple juice from the store.

Solutions

1. Total possible outcomes = Total number of cartons in the store
= 80 + 90 + 38 + 42 = 250
No. of favourable outcomes = No. of pineapple's cartons = 90
∴ P(choosing a pineapple juice carton) $= \frac{90}{250} = \frac{9}{25}$

2. No. of favourable outcomes = No. of banana juice cartons = 42
∴ P(choosing a banana juice carton) $= \frac{42}{250} = \frac{21}{125}$

3. Total number of cartons Sunny bought
= 4 + 3 + 3 = 10
No. of tetrapacks in 1 carton = 10
∴ No. of favourable outcomes = 3 × 10
∴ Total possible outcomes = Total number of tetrapacks Sunny has = 10 × 10 = 100
So, P(customer picks a banana juice tetrapack)
$= \frac{3 \times 10}{100} = \frac{3}{10}$

Or

Number of cartons left with storekeeper

$= 250 - 10 = 240$

Number of cartons he bought = 14

∴ Total number of cartons are with storekeeper now

$= 240 + 14 = 254$

∴ Total possible outcomes = Total number of tetrapack now = 254×10

∴ No. of favourable outcomes

= No. of tetrapack of pineapple juice

$= (90 - 4 + 14) \times 10$

So, P(selecting a tetrapack of pineapple juice from store)

$$= \frac{(90-4+14)\times 10}{254\times 10} = \frac{100}{254} = \frac{50}{127}$$

Case Study 5

Vivek is very fond of collecting balls of different colours. He has a total of 25 balls in his basket out of which five balls are red in colour and eight are white. Out of the remaining balls, some are green in colour and the rest are pink.

Based on the above information, solve the following questions:

Q 1. If the probability of drawing a pink ball is twice the probability of drawing a green ball, then find the number of pink balls.

Q 2. Find the probability of drawing a ball of colour other than green colour.

Q 3. Find the probability of drawing either a green or white ball.

Or

What is the probability that drawn ball is neither a pink nor a white ball?

Solutions

1. As the total number of balls is 25 and number of red balls + white balls is 13.

∴ Total number of green balls + pink balls

$= 25 - 13 = 12$

Let the number of pink balls be x.

Then the number of green balls $= 12 - x$

We know, Probability of an event E is given by

$$P(E) = \frac{\text{Number of outcomes favourable to E}}{\text{Total Number of possible outcomes}}$$

∴ Probability of drawing a pink ball $= \frac{x}{25}$ and

probability of drawing a green ball $= \frac{12-x}{25}$

It is given that.

P (pink ball) = 2 × P(green ball)

$$\Rightarrow \quad \frac{x}{25} = 2\times\left(\frac{12-x}{25}\right)$$

$$\Rightarrow \quad x = 24 - 2x \quad \Rightarrow \quad 3x = 24 \Rightarrow x = 8$$

Therefore, number of pink balls = 8

2. From part (1), number of green balls = 4

∴ Number of balls of colour other than green balls

$= 25 - 4 = 21$

∴ Probability of drawing a ball of colour other than green colour $= \frac{21}{25}$

3. The number of green balls = 4 and number of white balls = 8

Therefore, total number of green balls + white balls

$= 4 + 8 = 12$

∴ Probability of drawing either a green or a white ball $= \frac{12}{25}$

Or

The number of red balls = 5

and number of green balls = 4

∴ Total number of red balls + green balls

= 5 + 4 = 9

∴ Probability of drawing neither a pink ball nor a white ball = $\frac{9}{25}$

Very Short Answer Type Questions

Q 1. If a die is thrown once, find the probability of getting a number less than 3 and greater than 2. *[U. Imp.]*

Q 2. In a throw of a die, find the probability of getting an odd number less than 6.

Q 3. A die is thrown once. What is the probability of getting a prime number. *[CBSE 2020]*

Q 4. The probability of selecting a rotten apple randomly from a heap of 900 apples is 0.18. What is the number of rotten apples in the heap? *[CBSE 2017]*

Q 5. A box contains 90 discs, numbered from 1 to 90. If one disc is drawn at random from the box, find the probability that it bears a prime number less than 23.

Q 6. What is the probability that a randomly taken leap year has 52 Sundays? *[CBSE 2020]*

Short Answer Type-I Questions

Q 1. A child has a die whose six faces show the letters as shown below: *[CBSE 2020]*

A	A	B	C	C	C

The die is thrown once. What is the probability of getting (i) A, (ii) C?

Q 2. Find the probability that in a leap year there will be 53 Tuesdays. *[CBSE 2017]*

Q 3. A die is thrown once. Find the probability of getting a number which, (i) is a prime number (ii) lies between 2 and 6. *[NCERT EXERCISE; CBSE 2019]*

Q 4. Two different dice are tossed together. Find the probability:
(i) of getting a doublet.
(ii) of getting a sum 10, of the numbers on the two dice. *[CBSE 2018]*

Q 5. An integer is chosen at random between 1 and 100. Find the probability that it is:
(i) divisible by 8. (ii) not divisible by 8. *[CBSE 2018]*

Q 6. Cards marked with numbers 5 to 50 (one number on one card) are placed in a box and mixed thoroughly. One card is drawn at random from the box. Find the probability that the number on the card taken out is (i) a prime number less than 10, (ii) a number which is a perfect square. *[CBSE 2019]*

Q 7. From a well-shuffled deck of 52 playing cards, all diamond cards are removed. Now, a card is drawn from the remaining pack at random. Find the probability that the selected card is a king.

[CBSE 2023]

Q 8. A Group Housing Society has 600 members, who have their Houses in the campus and decided to hold a tree plantation drive on the occasion of New Year. Each household was given the choice of planting a samplings of its choice. The number of different types of samplings planted were:
(i) Neem-125
(ii) Peepal-165
(iii) Creepers-50
(iv) Fruit plants-150
(v) Flowering plants-110
On the opening ceremony. One of the plant is selected randomly for a prize. After reading the above passage, answer the following questions. What is the probability that the selected plant is:
(a) A fruit plant or a flowering plant?
(b) Either a Neem plant or a Peepal plant?

[CBSE 2020]

Short Answer Type-II Questions

Q 1. A bag contains 6 red balls and 4 black balls. A ball is drawn at random from the bag. What is the probability that the ball drawn is:
(i) red? (ii) not red? *[CBSE SQP 2023-24]*

Q 2. Two coins are tossed simultaneously. What is the probability of getting:
(i) at least one head? (ii) at most one tail?
(iii) a head and a tail? *[CBSE SQP 2022-23]*

Q 3. One card is drawn from a pack of 52 cards, each of the 52 cards being equally likely to be drawn. Find the probability that the card drawn is:
(i) a red king
(ii) '2' of spade
(iii) '10' of a black suit. *[CBSE 2016]*

Q 4. Five cards-ten, jack, queen, king and ace of diamonds, are well-shuffled with their face downwards. One card is then picked up at random.
(i) What is the probability that the card is the queen?
(ii) If the queen is drawn and put aside, what is the probability that the second card picked up is: (a) an ace? (b) a queen? *[NCERT EXERCISE]*

Q 5. In a cricket match, Rohit faces 100 balls. He hits 14 fours, 3 sixes and remaining singles in his score of 140 runs. Find the probability that on playing next ball he will:
(i) hit a four
(ii) make a single run
(iii) not be able to score.

Q 6. A bag contains 4 red, 3 green and 8 white balls. One ball is drawn at random from the bag. Find the probability of getting:
(i) a red ball or a white ball
(ii) neither a red ball nor a white ball *[CBSE 2017]*

Q 7. Red queen and black jacks are removed from a pack of 52 playing cards. A card is drawn at random from the remaining cards, after reshuffling them. Find the probability that the drawn card is:
(i) a king (ii) of red colour
(iii) a face card (iv) a queen.

Long Answer Type Questions

Q 1. A box contains 90 discs, numbered from 1 to 90. If one disc is drawn at random, then find the probability that it bears a multiple of 15.

[CBSE 2023]

Q 2. A box contains 90 discs which are numbered from 1 to 90. If one disc is drawn at random from the box, find the probability that it bears (i) a two-digits number, (ii) a number divisible by 5.

[NCERT EXERCISE; CBSE 2017]

Q 3. Cards numbered 1 to 30 are put in a bag. A card is drawn at random from the bag. Find the probability that the number on the drawn card is:

(i) not divisible by 3 (ii) a prime number greater than 7

(iii) not a perfect square number.

Q 4. Cards marked with numbers 1 to 100 are placed in a box and mixed thoroughly. One card is drawn from this box. Find the probability that number on the card is: *[CBSE 2017]*

(i) an even number

(ii) a number less than 4

(iii) a multiple of 6

(iv) a number divisible by 3.

Q 5. Out of a deck of 52 playing cards, two black kings and 4 red cards (not king) are removed. A card is drawn at random. Find the probability that the card drawn is:

(i) a black jack. (ii) a black queen.

(iii) a black card (iv) a king. *[CBSE 2017]*

Solutions

Very Short Answer Type Questions

1. There is no such number lying on a die which is less than 3 and greater than 2.
   ∴ Probability will be zero.
2. Possible outcomes = 1, 2, 3, 4, 5, 6
   Total number of possible outcomes = 6
   Favourable outcomes = 1, 3, 5
   Total number of favourable outcomes = 3
   So, probability of getting an odd number less than 6
   $$= \frac{3}{6} = \frac{1}{2}$$
3. If a die is thrown once.
   All possible outcomes = 1, 2, 3, 4, 5, 6
   ∴ Total number of possible outcomes = 6

TiP

1 is neither prime nor composite.

   Now, favourable outcomes (Prime Numbers) = 2, 3, 5
   ∴ Total number of favourable outcomes = 3
   So, P(getting a prime number)
   $$= \frac{\text{Number of favourable outcomes}}{\text{Number of possible outcomes}} = \frac{3}{6} = \frac{1}{2}$$
4. ∵ Probability of selecting a rotten apple
   $$= \frac{\text{Number of rotten apples}}{\text{Total number of apples}}$$
   $$\Rightarrow \quad 0.18 = \frac{\text{Number of rotten apples}}{900}$$
   ∴ Number of rotten apples = $900 \times 0.18 = 162$
5. Total number of possible outcomes = 90
   Favourable outcomes = Prime numbers less than 23
   = 2, 3, 5, 7, 11, 13, 17, 19
   Total number of favourable outcomes = 8
   So, the probability that it bears a prime number less than 23 $= \frac{8}{90} = \frac{4}{45}$
6. A leap year has 52 Sundays and 2 other days, they may be Sunday-Monday, Monday-Tuesday, Tue-Wed, Wed-Thur, Thur-Fri, Fri-Sat, Sat-Sun.

TiP

Students should remember that a leap year contains 366 days and an ordinary year contains 365 days.

   ∴ Number of all possible outcomes = 7
   Here, two cases out of seven have Sundays
   i.e., Sunday-Monday or Saturday-Sunday.
   If these two days are known then number of Sundays would be 53. So, leave these cases from possible outcomes and get favourable outcomes.
   ∴ Number of favourable outcomes = 7 – 2 = 5
   So,
   $$\text{Probability} = \frac{\text{Number of favourable outcomes}}{\text{All possible outcomes}} = \frac{5}{7}$$

Short Answer Type-I Questions

1. Given that, a die has six faces in which 3 faces has letter C, 2 faces has letter A and one face has letter B.
   And total possible outcomes = 6
   (i)Total favourable cases (when A comes) = 2
   So, the probability of getting A
   $$= \frac{\text{Favourable cases}}{\text{Possible outcomes}} = \frac{2}{6} = \frac{1}{3}$$
   (ii)Total favourable cases (when C comes) = 3
   So, the probability of getting C
   $$= \frac{\text{Favourable cases}}{\text{Possible outcomes}} = \frac{3}{6} = \frac{1}{2}$$
2. In a leap year there are 366 days
   We have, 366 days = 52 weeks and 2 days
   Thus, a leap year will have 52 Tuesdays and the remaining 2 days can be
   (Sun, Mon) or (Mon, Tues) or (Tues, Wed) or (Wed, Thurs) or (Thurs, Fri) or (Fri, Sat) or (Sat, Sun)
   Total number of possible cases = 7
   Total number of favourable cases = 2
   Hence, required probability
   $$= \frac{\text{Number of favourable cases}}{\text{Number of possible cases}} = \frac{2}{7}$$

COMMON ERROR

Some students confuse between ordinary year and leap year.

- *A ordinary year has 365 days.*
- *A leap year has 366 days.*

Some students take 365 days in a leap year and get a wrong answer.

3. Total number of possible outcomes
= 6 (*i.e.*, 1, 2, 3, 4, 5, 6)

(i) Let E_1 = Event of getting a prime number

Then total number of favourable outcomes
E_1 = 3 (i.e., 2, 3, 5)

∴ Probability of getting a prime number

$$= P(E_1) = \frac{3}{6} = \frac{1}{2} \text{ or } 0.5$$

(ii) Let E_2 = Event of getting a number between 2 and 6.

Then total number of favourable outcomes E_2 = 3
(*i.e.*, 3, 4 and 5)

∴ Probability of getting a number between 2 and 6.

$$= P(E_2) = \frac{3}{6} = \frac{1}{2} = 0.5$$

4. Total number of possible outcomes = 6 × 6 = 36

(i) Favourable outcomes = getting a doublet
= {(1, 1), (2, 2), (3, 3), (4, 4), (5, 5), (6, 6)}

∴ Total number of favourable outcomes = 6

So, the probability of getting a doublet $= \frac{6}{36} = \frac{1}{6}$

(ii) Favourable outcomes = {(4, 6), (5, 5), (6, 4)}

∴ Total number of favourable outcomes getting a sum 10 = 3

So, the probability of getting a sum 10 $= \frac{3}{36} = \frac{1}{12}$

5. Total number of possible outcomes = 98 (Numbers between 1 and 100)

(i) Numbers divisible by 8 are 8, 16, 24, 32, 40, 48, 56, 64, 72, 80, 88 and 96.

TR!CK

Series: 8, 16, 24, ..., 96 *forms an AP.*
Here, $a = 8, d = 16 - 8 = 8$ *and* $a_n = 96$
$\because a_n = a + (n-1)d$
$\therefore 96 = 8 + (n-1)\,8 \Rightarrow n = 11 + 1 = 12$

∴ Number of favourable outcomes = 12

So, probability of getting a number divisible by 8

$$= \frac{12}{98} = \frac{6}{49}$$

(ii) Probability of getting a number not divisible by 8
= 1 – probability of getting a number divisible by 8.

$$= 1 - \frac{6}{49} = \frac{43}{49} \qquad (\because P(E) + P(\bar{E}) = 1)$$

6. Total number of cards marked with 5 to 50
= 50–5 +1 = 46

∴ Total number of outcomes = 46

(I) Let E_1 = Event of drawing a prime number less than 10.

Number of favourable outcomes to E_1 = 2 (*i.e.* 5 and 7)

∴ Probability of drawing a prime number less than 10

$$= P(E_1) = \frac{2}{46} = \frac{1}{23}$$

(ii) Let E_2 = Event of drawing a perfect square number.

Number of favourable outcomes to E_2 = 5
(*i.e.*, 9, 16, 25, 36, 49)

∴ Probability of drawing a prime square number

$$= P(E_2) = \frac{5}{46}$$

7. Total number of cards = 52

In a well-shuffled deck of 52 playing cards, there are 13 diamond cards.

Total number of cards removed = 52 – 13 = 39

∴ Total number of possible outcomes = Remaining cards = 52 – 13 = 39.

Number of favourable outcomes = Number of kings
= (4 – 1) = 3

So, probability that the selected card is king

$$= \frac{3}{39} = \frac{1}{13}$$

8. (a) Out of the 600 plants, there are 150 fruit plants and 110 flowering plants.

So, $\text{required probability} = \frac{150 + 110}{600} = \frac{260}{600} = \frac{13}{30}$

(b) Out of the 600 plants, there are 290 (125 + 165) plants which are either neem plants or peepal plants.

So, $\text{required probability} = \frac{290}{600} = \frac{29}{60}$

Short Answer Type-II Questions

1. Total number of possible outcomes = total number of balls = 6 + 4 = 10

(i) There are 6 red balls.

∴ Total number of favourable outcomes = 6

So, probability that the ball drawn is red $= \frac{6}{10} = \frac{3}{5}$.

(ii)

TR!CK

$P(E) + P(\text{not } E) = 1$

∴ Probability that the ball drawn is not red
= 1 – probability that the ball drawn is red.

$$= 1 - \frac{3}{5} = \frac{2}{5}.$$

2. (i) Total number of outcomes = 2 × 2 = 4

Number of favourable outcomes of getting at least one head = 3 *i.e.*, {(H, T), (T, H), (H, H)}

∴ P (At least one head) $= \frac{3}{4}$

(ii) Number of favourable outcomes of getting at most one tail = 3 *i.e.*, (H, H), (T, H), (H, T))

∴ P (At most one tail) $= \frac{3}{4}$

(iii) Number of favourable outcomes of getting a head and a tall = 2 *i.e.*, ((H, T), (T, H)).

P (A head and a tall) $= \frac{2}{4} = \frac{1}{2}$

3. Total number of possible outcomes = 52

(i) Number of favourable outcomes = Number of red king = 2

So, probability that the card drawn is a red king

$$= \frac{2}{52} = \frac{1}{26}$$

(ii) Number of favourable outcomes = '2' of spade = 1

So, probability that the card drawn is '2' of spade

$$= \frac{1}{52}$$

(iii) Number of favourable outcomes = '10' of a black suit = 2

($\because$ two suits of black cards, each contain one card bearing number 10.)

So, probability that the card drawn is '10' of a black suit

$$= \frac{2}{52} = \frac{1}{26}$$

4. (i) Total number of cards = 5

Total number of queens = 1

$\therefore$ P(getting a queen)

$$= \frac{\text{Number of favourable outcomes}}{\text{Number of total possible outcomes}} = \frac{1}{5}$$

(ii) When the queen is drawn and put aside, the total number of remaining cards will be 4.

(a) Total number of aces = 1

$\therefore$ P(getting an ace) $= \frac{1}{4}$

(b) As queen is already drawn, therefore, the number of queens will be 0.

$\therefore$ P(getting a queen) $= \frac{0}{4} = 0$

5. Total number of outcomes

= Total number of balls faced = 100.

(i) Favourable outcomes

= Number of balls on which a 4 is hit = 14

So, probability that he will hit a four $= \frac{14}{100} = \frac{7}{50}$

(ii) Favourable outcomes = Number of balls on which a single run is taken.

Rohit's score in 14 fours and 3 sixes

$= 14 \times 4 + 3 \times 6$

$= 56 + 18 = 74$

Runs scored in singles = 140 – 74 = 66

$\therefore$ Number of balls on which a single is taken = 66

So, probability that he will make a single run

$$= \frac{66}{100} = \frac{33}{50}$$

(iii) Favourable outcomes = Number of balls in which he does not score

$= 100 - (14 + 3 + 66) = 17.$

So, probability that he will not be able to score $= \frac{17}{100}$.

6. Total number of possible outcomes = 4 + 3 + 8 = 15

(i) There are 4 red balls and 8 white balls.

$\therefore$ Total number of favourable outcomes = 4 + 8 = 12

So, probability of getting a red ball or a white ball $= \frac{12}{15} = \frac{4}{5}$

(ii) Probability of getting neither a red ball nor a white ball = 1 – Probability of getting a red ball or a white ball $= 1 - \frac{4}{5} = \frac{1}{5}$

7. Total number of cards = 52

Total number of cards removed = 2 + 2 = 4

$\therefore$ Total number of possible outcomes

= Remaining cards = 52 – 4 = 48

(i) Number of favourable outcomes = Number of kings = 4

So, probability of getting a king $= \frac{4}{48} = \frac{1}{12}$

(ii) Number of favourable outcomes = Number of remaining red colour cards = 26 – 2 = 24

So, probability of getting a red colour card $= \frac{24}{48} = \frac{1}{2}$

(iii) Number of favourable outcomes = Number of remaining face cards = 12 – 4 = 8

So, probability of getting a face card $= \frac{8}{48} = \frac{1}{6}$

(iv) Number of favourable outcomes = Number of remaining queens = 4 – 2 = 2

So, probability of getting a queen $= \frac{2}{48} = \frac{1}{24}$

COMMON ERROR

Some students commit the error in finding total outcomes of the event.

Long Answer Type Questions

1. Given total number of discs in the box = 90

If a disc is drawn at random then, total possible outcomes = (1, 2, 3, ..., 90) = 90

Now, numbers multiple of 15

= (15, 30, 45, 60, 75, 90) = 6

$\therefore$ Total number of favourable outcomes of the event of bearing a number on the disc multiple of 15 = 6.

So, probability that disc bears a multiple of 15

$$= \frac{\text{No. of favourable outcomes}}{\text{No. of possible outcomes}} = \frac{6}{90} = \frac{1}{15}$$

2. Given total number of discs in the box = 90

If a disc is drawn at random then total possible outcomes = (1, 2, 3, ..., 90) = 90

(i) Two-digit numbers in these outcomes

= (10, 11, 12, ..., 90)

= 90 – 10 + 1 = 81

$\therefore$ Favourable outcomes of the event of bearing a two digit number on the disc = 81

And total possible outcomes = 90

Therefore, P(bearing a two digits number)

$$= \frac{\text{Number of favourable outcomes}}{\text{Number of possible outcomes}} = \frac{81}{90} = \frac{9}{10}$$

(ii) Numbers divisible by 5 = (5, 10, 15, 20, ... 90) = 18

TRICK

Sequence: 5, 10, 15, ..., 90 *form an A.P. because the difference between two consecutive number is* 5 *(constant).*

$\because a_n = a + (n-1)d$

$\therefore 90 = 5 + (n-1)\,5$

$\Rightarrow n - 1 = 17 \Rightarrow n = 18$

So, number of terms is 18.

$\therefore$ Favourable outcomes of the event of bearing a number on the disc divisible by 5 = 18

and total possible outcomes = 90

Therefore, P(bearing a number divisible by 5)

$$= \frac{\text{Number of favourable outcomes}}{\text{Number of possible outcomes}} = \frac{18}{90} = \frac{1}{5}$$

COMMON ERROR

Some students make mistake in counting the favourable outcomes of two digit numbers. They counts 10, 11, ..., 90 *as* 80 *rather than* 81 *in precocity.*

3. Total number of possible outcomes = 30

(i) Numbers divisible by 3 are 3, 6, 9, 12, 15, 18, 21, 24, 27, 30

Number of favourable outcomes (numbers not divisible by 3) = 30 – 10 = 20

So, probability of getting a number not divisible by 3 $= \frac{20}{30} = \frac{2}{3}$

(ii) Favourable outcomes (prime numbers greater than 7) = {11, 13, 17, 19, 23, 29}

Number of favourable outcomes = 6

So, probability of getting a prime number greater than 7 $= \frac{6}{30} = \frac{1}{5}$

(iii) Perfect squares between 1 to 30 are 1, 4, 9, 16, 25.

So, numbers which are not perfect squares

$= 30 - 5 = 25$

Number of favourable outcomes = 25

So, probability of getting a non-perfect square number $= \frac{25}{30} = \frac{5}{6}$

COMMON ERRORS

Some students commit the following errors:

- *Total outcomes of event are incorrect.*
- *Favourable outcomes are incorrect.*
- *The result are not given in simplest form, e.g.,* $\frac{6}{30} = \frac{1}{5}$

4. Total number of possible outcomes = 100

(i) Favourable events = An even number

= {2, 4, 6, ..., 100}

TIP

All necessary outcomes must be listed before finding probability and all answers must be in the simplest form.

Total number of favourable outcomes = 100

Number of even numbers $= \frac{100}{2} = 50$

So, the required probability $= \frac{50}{100} = \frac{1}{2}$

(ii) Favourable outcomes = A number less than 4

= {1, 2 and 3}

Total number of favourable outcomes = 3

So, the required probability $= \frac{3}{100}$

(iii) Favourable outcomes = A multiple of 6

= {6, 12, 18, 24, ..., 96}

TRICK

Sequence: 6, 12, 18, ..., 96 *forms an A.P.*

$\because a_n = a + (n-1)d$

$\therefore 96 = 6 + (n-1)\,6$

$\Rightarrow 15 = n - 1 \Rightarrow n = 16$

Total number of favourable outcomes = 16

So, the required probability $= \frac{16}{100} = \frac{4}{25}$

(iv) Favourable outcomes = A number divisible by 3

= {3, 6, 9, 12, ..., 99}

TRICK

Sequence: 3, 6, 9, ..., 99 *forms an A.P.*

$\because a_n = a + (n-1)d$

$\therefore 99 = 3 + (n-1)\,3$

$\Rightarrow 32 = n - 1 \Rightarrow n = 33$

Total number of favourable outcomes = 33

So, the required probability $= \frac{33}{100}$

5. Total number of possible outcomes = 52 – (2 + 4) = 46

(i) Number of favourable outcomes (black jacks) = 2

So, probability of getting a black jack $= \frac{2}{46} = \frac{1}{23}$

(ii) Number of favourable outcomes (black queens) = 2

So, probability of getting a black queen

$$= \frac{2}{46} = \frac{1}{23}$$

(iii) Number of favourable outcomes (black cards)

= Total number of black cards – Two black kings

= 26 – 2 = 24

So, probability of getting a black card

$$= \frac{24}{46} = \frac{12}{23}$$

(iv) Number of favourable outcomes (kings)

= Total number of kings – Two black kings

= 4 – 2 = 2

So, probability of getting a king $= \frac{2}{46} = \frac{1}{23}$

Chapter Test

Multiple Choice Questions

Q 1. Two dice are rolled simultaneously. The probability that they show different faces is:

a. $\frac{7}{12}$ b. $\frac{11}{12}$

c. $\frac{1}{6}$ d. $\frac{5}{6}$

Q 2. In a single throw of a pair of dice, the probability of getting the sum as a perfect square is:

a. $\frac{13}{36}$ b. $\frac{11}{36}$

c. $\frac{27}{36}$ d. $\frac{7}{36}$

Assertion and Reason Type Questions

Directions (Q.Nos. 3-4): *In the following questions, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option:*

a. Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A)

b. Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A)

c. Assertion (A) is true but Reason (R) is false

d. Assertion (A) is false but Reason (R) is true

Q 3. Assertion (A): If a die is thrown, the probability of getting a number less than 4 and greater than 3 is zero.

Reason (R): Probability of an impossible event is zero.

Q 4. Assertion (A): Seven face cards are removed from a deck of cards and then cards are well shuffled. Then the probability of drawing a face card is $\frac{5}{52}$.

Reason (R): King, Queen and Jack are known as face cards. So, there are 12 face cards in total.

Fill in the Blanks

Q 5. The probability of any event associated to a random

Q 6. If the probability of getting a bad eggs in a lot of 400 is 0.035, then the number of bad eggs in the lot is .....

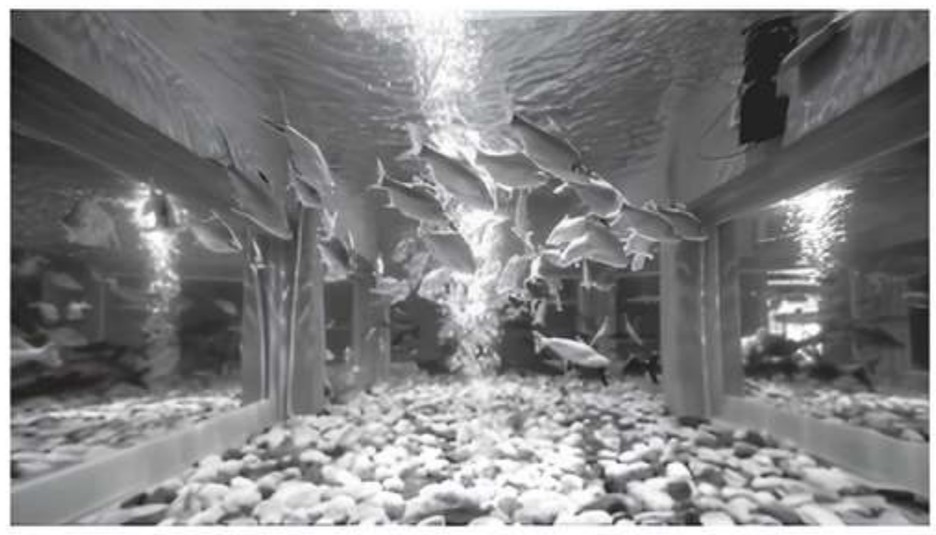
True/False

Q 7. A letter of English alphabets is chosen at random. The probability that it is a vowel is $\frac{5}{26}$.

Q 8. Two dice are thrown together, the probability of getting the same number on all the dice is $\frac{1}{36}$.

Case Study Based Question

Q 9. Rohit goes to the market to buy an aquarium for his house. He asked the shopkeeper to put some fish in the aquarium. The shopkeeper takes out 13 guppy fish, 18 flowerhorn fish, 12 koi fish and 11 angle fish from the big tank he had and put them in the aquarium that Rohit has bought. Now, he select a fish at random.



Based on the above information, solve the following questions:

(i) If total number of male fish in the aquarium is 36, then find the probability of selecting a female fish.

(ii) Find the probability of selecting a koi fish.

(iii) Find the probability of selecting either angle fish or guppy fish.

Or

Find the probability of selecting neither angle fish

Very Short Answer Type Questions

Q 10. A card is drawn from a well shuffled pack of 52 playing cards. Find the probability that the card is a red or club.

Q 11. The probability of selecting a rathen apple randomly from a heap of 900 apples is 0.18. What is the number of rotten apples in the heap.

Short Answer Type-I Questions

Q 12. A bag contains 8 red balls and some blue balls. If the probability of drawing a blue ball is three times of a red ball then, find the number of blue balls in the bag.

Q 13. A letter is chosen at random from the letters of the word 'ASSASSINATION'. Find the probability that the letter chosen is a:

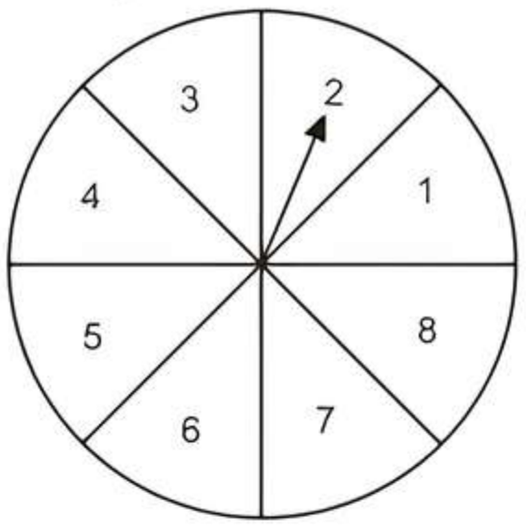
(i) vowel, (ii) consonant

Short Answer Type-II Questions

Q 14. A game of chance of spinning an arrow which comes to rest pointing at one of the numbers 1, 2, 3, 4, 5, 6, 7, 8 and there are equally likely outcomes. What is the probability that it will point at:

(i) 8, (ii) an odd number,

(iii) a number greater than 2?



Q 15. A bag contains 5 black, 7 red and 3 white balls. A ball is drawn from the bag at random. Find the probability that the ball drawn is:

(i) red (ii) black or white (iii) not black

Long Answer Type Question

Q 16. 17 cards numbered 1, 2, 3, ..., 17 are put in a box and mixed thoroughly. One person draws a card from the box. Find the probability that the number on the card is:

(i) odd

(ii) a prime

(iii) divisible by 3

(iv) divisible by 3 and 2 both.