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,

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

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

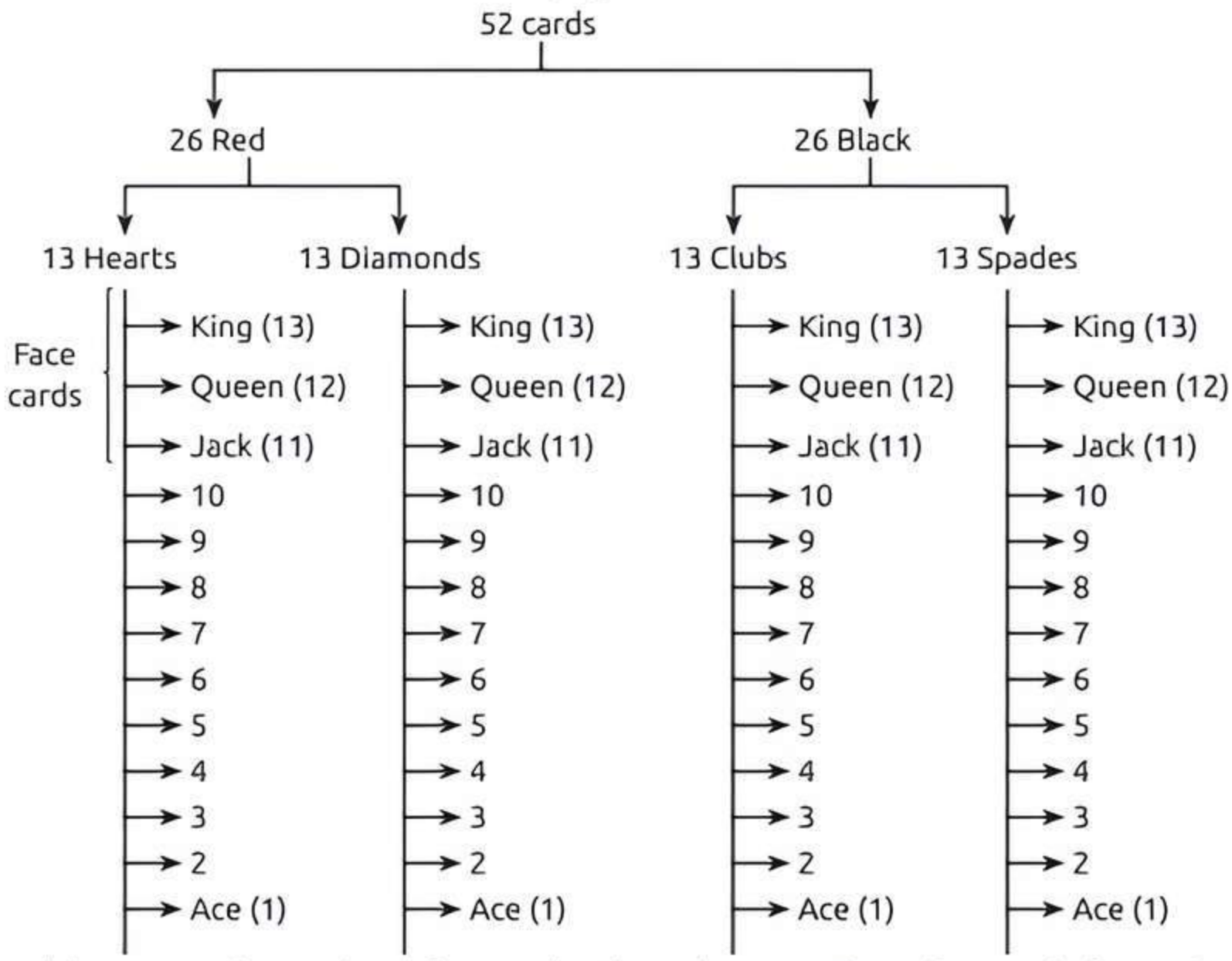
Or

$P(\text{not } E) = 1 - P(E)$ 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 cannot be the probability of an event? *[CBSE 2021 Term-I]*

a. 0.01 b. 3% c. $\frac{16}{17}$ d. $\frac{17}{16}$

Q 2. A fair dice is rolled. Probability of getting a number x such that $1 \leq x \leq 6$ is:

a. 0
b. 1
c. between 0 and 1
d. Cannot be determined

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. 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 5. The probability of passing a certain test is $\frac{x}{24}$. If the probability of not passing it is $\frac{7}{8}$, then is equal to:

a. 2 b. 3 c. 4 d. 6

Q 6. A fair die is thrown once. The probability for getting a composite number less than 5 is:

a. $\frac{1}{3}$ b. $\frac{1}{6}$ c. $\frac{2}{3}$ d. 0

Q 7. In tossing a die, the probability of getting an even number or a number less than 4 is:

a. 1 b. $\frac{1}{2}$ c. $\frac{2}{3}$ d. $\frac{5}{6}$

Q 8. 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 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. Two dice are rolled simultaneously. What is the probability that 6 will come up at least once? *[CBSE SQP 2022-23]*

a. $\frac{1}{6}$ b. $\frac{7}{36}$ c. $\frac{11}{36}$ d. $\frac{13}{36}$

Q 11. A dice is rolled twice. The probability that 5 will not come up either time is: *[CBSE 2021 Term-I]*

a. $\frac{11}{36}$ b. $\frac{1}{3}$ c. $\frac{13}{36}$ d. $\frac{25}{36}$

Q 12. In a single throw of two dice, the probability of getting 12 as a product of two number obtained is: *[CBSE 2023]*

a. $\frac{1}{9}$ b. $\frac{2}{9}$ c. $\frac{4}{9}$ d. $\frac{5}{9}$

Q 13. Two dice are thrown together. The probability of getting the difference of numbers on their upper faces equals to 3 is: *[CBSE 2023]*

a. $\frac{1}{9}$ b. $\frac{2}{9}$ c. $\frac{1}{6}$ d. $\frac{1}{12}$

Q 14. 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 15. 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 16. 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 17. 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 18. The probability of a non-leap year having 53 Monday is:

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

Q 19. 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 20. 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 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 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 24. A bag contains 24 balls of which x are red, $2x$ are white and $3x$ are blue. A ball is selected at random. What is the probability that the drawn ball is white or blue?

a. 1/2 b. 2 c. 5/6 d. 7/12

Q 25. A number is selected at random from the numbers 2, 3, 3, 5, 5, 5, 7, 7, 7, 7, 9, 9, 9, 9, 9 at random. Find the probability that the selected number is their median.

a. $\frac{1}{3}$ b. $\frac{4}{15}$

c. $\frac{3}{5}$ d. $\frac{2}{3}$

Q 26. In a family of 3 children, the probability of having at least one boy is:

a. $\frac{7}{8}$ b. $\frac{1}{8}$

c. $\frac{5}{8}$ d. $\frac{3}{4}$

Q 27. A letter is chosen at random from the letters of the word 'ASSASSINATION', then the probability that the letter chosen is a vowel is in the form of $\frac{6}{2x+1}$, then x is equal to:

a. 5 b. 6 c. 7 d. 8

Q 28. 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 29. 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 30. There is a green square board of side '$2a$' unit circumscribing a red circle. Jayadev is asked to keep a dot on the above said board. Find the probability that he keeps the dot on the green region. *[CBSE SQP 2023-24]*

a. $\frac{\pi}{4}$ b. $\frac{4-\pi}{4}$ c. $\frac{\pi-4}{4}$ d. $\frac{4}{\pi}$

Assertion & Reason Type Questions

Directions (Q. Nos. 31-36): *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 31. **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 32. **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 33. **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 34. **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 35. **Assertion (A): Three unbiased coins are tossed together, then the probability of getting exactly 1 head is $\frac{3}{8}$.**

Reason (R): Favourable number of outcomes do not lie in the sample space of total number of outcomes.

Q 36. Assertion (A): In a game, the entry fee is ₹ 10. The game consists of tossing of 3 coins. If one or two heads show, Amita won the game and gets entry fee. The probability, of she gets the entry fee is $\frac{3}{4}$.

Reason (R): When three coins are tossed together, all the outcomes are {HHH, HHT, HTH, THH, HTT, THT, TTH and TTT }.

Fill in the Blanks Type Questions

Q 37. Probability of an event cannot be ..... (Negative/positive).

Q 38. The outcomes which ensure the occurrence of an event are called ..... outcomes.

Q 39. The set of all possible outcomes of a random experiment is a ..... space.

Q 40. In tossing a die, the probability of getting a number 8 is .....

Q 41. 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 42. The probability of an event is greater than or equal to 0 and less than or equal to 1. *[NCERT EXERCISE]*

Q 43. If P(E) = 0.05, then the probability of 'not E' is 0.85.

Q 44. The probability of getting any day in a week is 1.

Q 45. The probability of getting a prime number if a die is thrown once, is 1/2.

Q 46. Two different coins are tossed simultaneously. The probability of getting at least one head is $\frac{3}{4}$.

Solutions

1. (d) $\frac{17}{16}$ 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) Here, favourable outcomes = 6
and total number of possible outcomes = 6
$\therefore$ Required probability $= \frac{6}{6} = 1$

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. (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) $= \frac{3}{4}$

5. (b) Let E be the event 'passing the test'.

$\therefore$ $P(E) = \frac{x}{24}$

Also, P (not passing the test) $= P(\overline{E}) = \frac{7}{8}$

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

$\frac{x}{24} + \frac{7}{8} = 1 \Rightarrow \frac{x}{24} = 1 - \frac{7}{8}$

$\Rightarrow$ $x = \frac{24}{8} = 3$

6. (b) The outcomes are 1, 2, 3, 4, 5, 6. Out of these, 4 is the only composite number which is less than 5.
$\therefore$ Favourable outcomes = 1
and Total possible outcomes = 6
$\therefore$ Required probability $= \frac{1}{6}$

7. (d) Total possible outcomes are {1, 2, 3, 4, 5, 6} *i.e.*, 6 in number.
Favourable outcomes = getting an even numbers or less than 4
$= \{2, 4, 6\}$ or $\{1, 2, 3\}$
$= \{1, 2, 3, 4, 6\}$
$\therefore$ Number of favourable outcomes = 5
$\therefore$ Required probability $= \frac{5}{6}$

8. (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 $= 0.035 \times 400 = 14$

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. (c) The number of favourable cases in which 6 occurs at least one die
= 11, *i.e.*, {(1, 6), (2, 6), (3, 6), (4, 6), (5, 6), (6, 6), (6, 1), (6, 2), (6, 3), (6, 4), (6, 5)}
Here, total number of outcomes is 36.
$\therefore$ Required probability $= \frac{11}{36}$

11. (d) Total number of possible outcomes $= 6 \times 6 = 36$.
The favourable outcomes of getting 5 will come either time = 11 {*i.e.* (5. 1). (5.2). (5.3). (5.4). (5.5). (5.6). (1.5). (2.5). (3.5). (4.5). (6.5)}
$\therefore$ Probability of getting 5 will come any time

$$= \frac{11}{36}$$

$\therefore$ Required probability of getting 5 will not come up either time $= 1 - \frac{11}{36} = \frac{25}{36}$

12. (a) Favourable outcomes
= 12 as a product of two numbers
= (2. 6). (3. 4). (4. 3). (6. 2)
$\therefore$ Number of favourable outcomes $= 4$
Number of all possible outcomes $= 6 \times 6 = 36$

$\therefore$ Required probability $= \frac{4}{36} = \frac{1}{9}$

13. (c) Favourable outcomes
= Difference of numbers on their upper faces equals to 3
= (1. 4). (2. 5). (3. 6). (4. 1) (5. 2). (6. 3)
$\therefore$ Number of favourable outcomes $= 6$
Number of all possible outcomes = $6 \times 6 = 36$

$\therefore$ Required probability $= \frac{6}{36} = \frac{1}{6}$

14. (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 $= \frac{12}{52} = \frac{3}{13}$

15. (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)

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

16. (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 $= \frac{44}{52} = \frac{11}{13}$

17. (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 $= \frac{1}{25}$

18. (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.*

19. (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 $= \frac{4}{100} = \frac{1}{25}$

20. (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 $= \frac{4}{6} = \frac{2}{3}$

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. (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.

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

24. (c) Total number of balls = 24
$\therefore x + 2x + 3x = 24 \Rightarrow 6x = 24 \Rightarrow x = 4$.
$\therefore$ Number of red balls = $x = 4$
Number of white balls = $2x = 8$.
Number of blue balls = $3x = 12$
Total number of possible outcomes = 24

Let E be the event that the ball drawn is white or blue.

$\therefore$ Number of outcomes favourable to E = 8 + 12 = 20

$$\therefore \quad P(E) = \frac{20}{24} = \frac{5}{6}$$

25. (b) Total number of all possible outcomes = 15

The given number in ascending order are as follows:

2, 3, 3, 5, 5, 5, 7, 7, 7, 7, 9, 9, 9, 9, 9

Here, $n = 15$, which is odd

$$\therefore \quad \text{Median} = \left(\frac{n+1}{2}\right)\text{th observation}$$

$$= \left(\frac{15+1}{2}\right)\text{th observation}$$

$$= 8\text{th observation} = 7$$

As 7 occurs 4 times.

So, favourable number of outcomes = 4

$\therefore$ Required probability = 4/15

COMMON ERROR

Mostly students commit the error in finding favourable outcomes in precocity.

26. (a) Let B denotes boy and G denotes girl.

$\therefore$ Total possible outcomes are

{BBB, BBG, BGB, GBB, BGG, GBG, GGB, GGG) *i.e.*, 8.

Favourable outcomes of having at least one boy are {BBB, BBG, BGB, GBB, BGG, GBG, GGB} *i.e.*, 7.

$\therefore$ Required probability $= \frac{7}{8}$

27. (b) There are 13 letters in the word 'ASSASSINATION' out of which one letter can be chosen in 13 ways.

Hence, total number of outcomes = 13

There are 6 vowels in the word 'ASSASSINATION'.

So, there are 6 ways of selecting a vowel.

Hence, required probability $= \frac{6}{13}$

But given that $\frac{6}{2x+1} = \frac{6}{13}$

$$\Rightarrow \quad 2x + 1 = 13 \Rightarrow 2x = 12$$

$$x = 6$$

28. (a) Possible outcomes (English Alphabets)

= {A, B,.....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 $= \frac{8}{26} = \frac{4}{13}$

29. (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

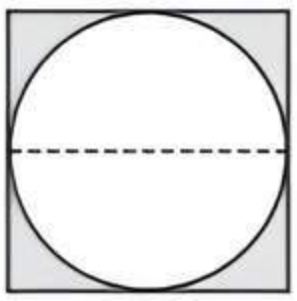
$\therefore$ Total number of favourable outcomes = 22

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

COMMON ERROR

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

30. (b) Given side of a green square board = 2*a* unit



$\therefore$ Diameter of circle = Side of a square = 2*a* unit

$\therefore$ Its radius $= \frac{2a}{2} = a$ unit

Now, favourable region = shaded region, *i.e.*, the dot on the green region.

= Area of green square board – Area of red circle

$= (2a)^2 - \pi r^2 = 4a^2 - \pi (a)^2$

$= (4 - \pi)a^2$ sq. unit

Possible region = area of square

$$= (2a)^2 = 4a^2$$

$\therefore$ P (keeps the dot on the green region)

$$= \frac{\text{Favourable region}}{\text{Possible region}}$$

$$= \frac{(4-\pi)a^2}{4a^2} = \frac{4-\pi}{4}$$

31. (b) **Assertion (A):** Total possible outcomes = 2 × 2 = 4

Number of favourable outcomes of getting no tail = 1 (*i.e.*, (H, H))

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

So, Assertion (A) is true.

Reason (R): Total possible outcomes = 2

Number of favourable outcomes = 1 (*i.e.*, H)

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

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).

32. (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.

33. (a) **Assertion (A):** Let E be the event 'Sanla win the match'.
So, probability of Sanla winning the match $= P(E) = 0.68$

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

$\therefore$ 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).

34. (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

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

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).

35. (c) **Assertion (A):** Total possible outcomes are {HHH, HHT, HTH, THH, TTH, THT, HTT, TTT} *i.e.*, 8
Let E be the event of getting exactly 1 head.
$\therefore$ Outcomes favourable to E are {TTH, THT, HTT} *i.e.*, 3

$P(E) = \frac{3}{8}$

So, Assertion (A) is true.
Reason (R): Favourable outcomes always lies in the sample space of total number of outcomes.
So, Reason (R) is false.
Hence, Assertion (A) is true but Reason (R) is false.

36. (a) **Assertion (A):** In case of tossing three coins, total number of possible outcomes = 8
Favourable outcomes = one or two heads
{HHT, HTH, THH, HTT, THT, TTH} *i.e.*, 6.

$\therefore$ Required probability $= \frac{6}{8} = \frac{3}{4}$

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).

37. Negative

38. Favourable

39. Sample

40. 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 $= \frac{0}{6} = 0$

41. 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

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

42. True

43.

TR!CK

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

Given, $P(E) = 0.05$

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

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

$= 1 - 0.05$

$= 0.95$

Hence, given statement is false.

44. 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.

45. 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.

46. 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 a club, men are playing the card game. A man named Sanjeev draw a card from a well shuffled deck of cards.

Based on the above information, solve the following questions:

Q 1. Find the probability of getting a king of black colour:

a. $\frac{1}{26}$ b. $\frac{1}{12}$ c. $\frac{1}{52}$ d. $\frac{1}{4}$

Q 2. Find the probability of getting a face card:

a. $\frac{1}{26}$ b. $\frac{1}{13}$ c. $\frac{2}{13}$ d. $\frac{3}{13}$

Q 3. Find the probability of getting a jack of clubs.

a. $\frac{1}{26}$ b. $\frac{1}{52}$

c. $\frac{3}{52}$ d. $\frac{3}{26}$

Q 4. Find the probability of getting a black face card:

a. $\frac{3}{13}$ b. $\frac{1}{13}$

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

Q 5. Find the probability of getting a diamond card is:

a. $\frac{1}{26}$ b. $\frac{1}{13}$

c. $\frac{1}{52}$ d. $\frac{1}{4}$

Solutions

1. Total number of possible outcomes = 52
   There are 26 black cards, in which 2 black kings.
   ∴ Favourable outcomes = 2
   ∴ P (getting a king of black colour)

$$= \frac{\text{Favourable outcome}}{\text{Possible outcomes}}$$

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

   So, option (a) is correct.
2. Total number of possible outcomes = 52
   In 52 playing cards, there are 12 face cards.
   ∴ Favourable outcomes = 12
   ∴ P(getting a face card)

$$= \frac{\text{Favourable outcomes}}{\text{Possible outcomes}} = \frac{12}{52} = \frac{3}{13}$$

   So, option (d) is correct.
3. Total number of possible outcomes = 52
   There are 13 club cards, in which only 1 Jack.
   Now, number of Jack in club cards = 1
   ∴ Favourable outcome = 1
   ∴ P(getting a jack of clubs)

$$= \frac{\text{Favourable outcomes}}{\text{Possible outcomes}} = \frac{1}{52}$$

   So, option (b) is correct.
4. Total number of possible outcomes = 52
   There are 12 face cards in which 6 red face cards and 6 black face cards.
   Now, number of black face cards = 6
   ∴ Favourable outcomes = 6
   ∴ P(getting a black face card)

$$= \frac{\text{Favourable outcomes}}{\text{Possible outcomes}}$$

$$= \frac{6}{52} = \frac{3}{26}$$

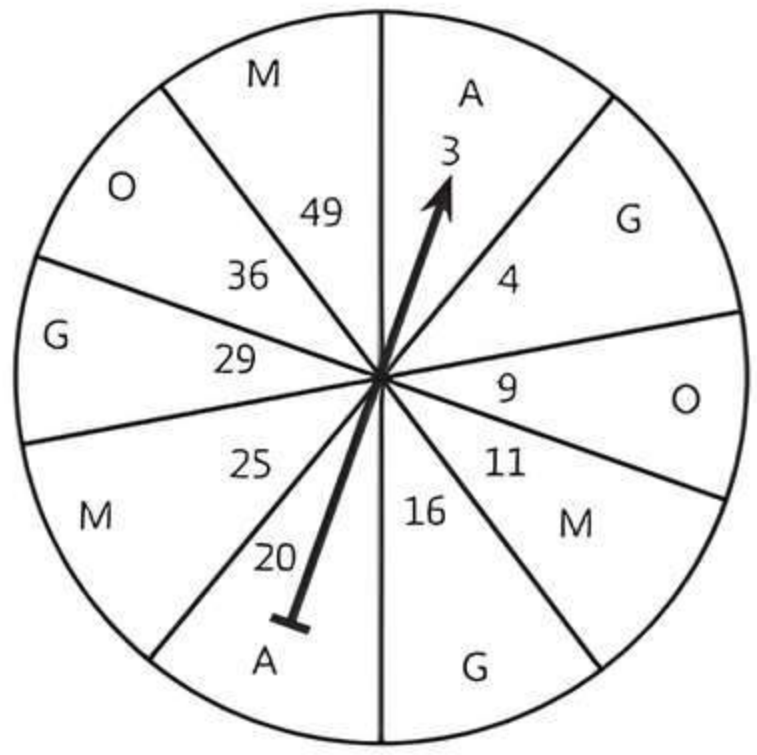
   So, option (d) is correct.
5. Total number of possible outcomes = 52
   In 52 playing cards, there are 13 diamond cards.
   ∴ Favourable outcomes = 13
   P(getting a diamond)

$$= \frac{\text{Favourable outcomes}}{\text{Possible outcomes}} = \frac{13}{52} = \frac{1}{4}$$

   So, option (d) is correct.

Case Study 2

An unbiased game to chance as shown below consists of spinning the wheel on which different areas have been marked with different fruits such as apple, grapes, mango and orange denoted by the alphabets A, G, M and O on the wheel respectively. Numbers have been marked on different parts and each of these is equally likely. The prize depends on the number at which the arrow points once the wheel comes to a rest.



Based on the above information, solve the following questions:

Q 1. The probability that the arrow will point at a prime number is:

a. 0 b. $\frac{3}{10}$

c. $\frac{1}{2}$ d. $\frac{3}{5}$

Q 2. The probability that the arrow will point a perfect square number is:

a. $\frac{2}{5}$ b. $\frac{3}{5}$

c. $\frac{1}{2}$ d. $\frac{7}{10}$

Q 3. The probability of arrow pointing towards grapes 'G' is:

a. $\frac{1}{2}$ b. $\frac{3}{10}$

c. $\frac{2}{5}$ d. $\frac{1}{10}$

Q 4. The probability of arrow pointing towards a number divisible by 4 is:

a. 0 b. $\frac{3}{10}$

c. $\frac{3}{4}$ d. $\frac{2}{5}$

Q 5. The probability of arrow pointing towards Banana 'B' is:

a. 0 b. 1

c. $\frac{1}{2}$ d. $\frac{2}{5}$

Solutions

1. The total number of possible outcomes = 10
   Favourable outcomes = {3, 11, 29} *i.e.*, prime numbers
   ∴ Number of favourable outcomes = 3
   ∴ Required probability $= \frac{3}{10}$
   So, option (b) is correct.
2. The total number of possible outcomes = 10
   Favourable outcomes = {4, 9, 16, 25, 36, 49} *i.e.*, perfect square numbers
   ∴ Number of favourable outcomes = 6
   ∴ Required probability $= \frac{6}{10} = \frac{3}{5}$
   So, option (b) is correct.
3. The total number of possible outcomes = 10
   Favourable outcomes = (G, G, G) *i.e.*, grapes
   ∴ Number of favourable outcomes = 3
   ∴ Required probability $= \frac{3}{10}$
   So, option (b) is correct.
4. The total number of possible outcomes = 10
   Favourable outcomes = (4, 16, 20, 36) *i.e.*, Numbers divisible by 4.
   ∴ Number of favourable outcomes = 4
   ∴ Required probability $= \frac{4}{10} = \frac{2}{5}$
   So, option (d) is correct.
5. The total number of possible outcomes = 10
   Favourable outcomes = 0 (No banana *i.e.*, 'B' pointing on the wheel)
   ∴ Number of favourable outcome = 0
   ∴ Required probability $= \frac{0}{10} = 0$
   So, option (a) is correct.

Case Study 3

Computer Based Learning (CBL) refers to any teaching methodology that makes use of computers for information transmission. At an elementary school level, computer applications can be used to display multimedia lesson plans. a survey was done on 1000 elementary and secondary schools of Assam and they were classified by the number of computers they had.

Number of Computers	1-10	11-20	21-50	51-100	101 and more
Number of Schools	250	200	290	180	80

One school is chosen at random,

Based on the above information, solve the following questions: *[CBSE 2023]*

Q 1. Find the probability that the school chosen at random has more than 100 computers.

Q 2. (i) Find the probability that the school chosen at random has 50 or fewer computers.

Or

(ii) Find the probability that the school chosen at random has no more than 20 computers.

Q 3. Find the probability that the school chosen at random has 10 or less than 10 computers.

Solutions

1. Total number of possible outcomes = Number of schools = 1000
   Number of favourable outcomes = Number of schools has more than 100 computers = 80
   ∴ Required probability $= \frac{80}{1000} = \frac{2}{25}$

2. Total number of possible outcomes = No. of schools = 1000

No. of favourable outcomes = No. of schools has 50 or fewer computers = 250 + 200 + 290

= 740

$\therefore$ Required probability $= \frac{740}{1000} = \frac{37}{50}$

Or

Total number of possible outcomes

= No. of schools = 1000

No. of favourable outcomes = No. of schools has no more than 20 computers = 250 + 200 = 450

$\therefore$ Required probability $= \frac{450}{1000} = \frac{9}{20}$

3. Total number of possible outcomes

= No. of schools = 1000

No. of favourable outcomes

= No. of schools has 10 or less than 10 computers.

= 250

$\therefore$ Required probability $= \frac{250}{1000} = \frac{1}{4}$

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.

Or

What is the probability that selecting carton is of banana juice?

Q 2. 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.

Q 3. 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

$\therefore$ P(choosing a pineapple juice carton) $= \frac{90}{250} = \frac{9}{25}$

Or

No. of favourable outcomes = No. of banana juice cartons = 42

$\therefore$ P(choosing a banana juice carton) $= \frac{42}{250} = \frac{21}{125}$

2. Total number of cartons Sunny bought

= 4 + 3 + 3 = 10

No. of tetrapacks in 1 carton = 10

$\therefore$ No. of favourable outcomes = 3 ×10

$\therefore$ Total possible outcomes = Total number of tetrapacks Sunny has = 10 × 10 = 100

So, P(customer picks a banana juice tetrapack)

$= \frac{3 \times 10}{100} = \frac{3}{10}$

3. Number of cartons left with storekeeper

= 250 – 10 = 240

Number of cartons he bought = 14

$\therefore$ Total number of cartons are with storekeeper now

= 240 + 14 = 254

$\therefore$ Total possible outcomes = Total number of tetrapack now = 254 ×10

$\therefore$ No. of favourable outcomes

= No. of tetrapack of pineapple juice

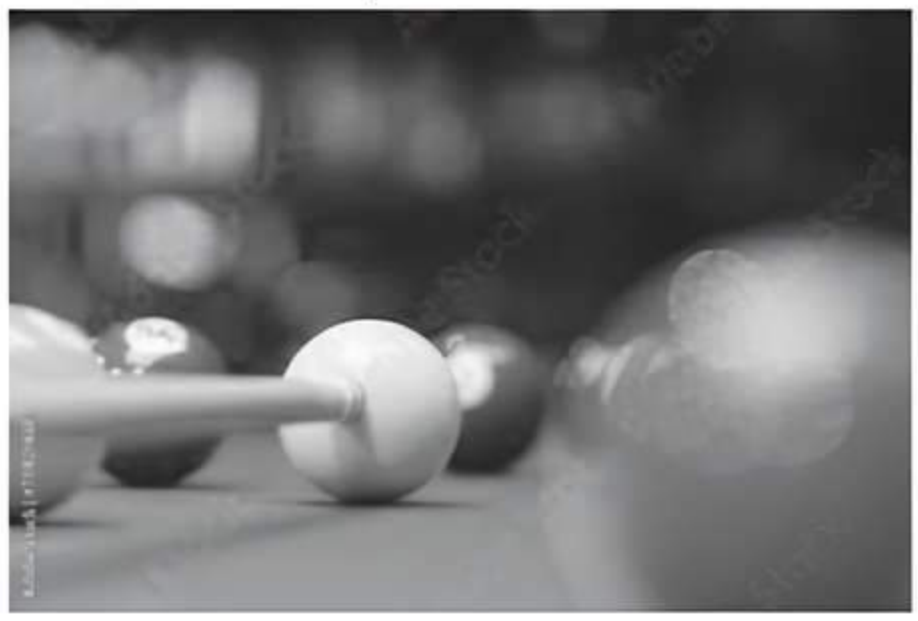
= (90 – 4 + 14) ×10

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

'Eight Ball' is a game played on a pool table with 15 balls numbered 1 to 15 and a 'cue ball' that is solid and white. Of the 15 numbered balls eight are solid (non-white) coloured and numbered 1 to 8 and seven are striped balls numbered 9 to 15.



The 15 numbered pool balls (no cue ball) are placed in a large bowl and mixed, then one ball is drawn out at random. *[CBSE 2023]*

Based on the given information, solve the following questions:

Q 1. What is the probability that the drawn ball bears numbers 8?

Q 2. What is the probability that the drawn ball bears an even number?

Or

What is the probability that the drawn ball bears a number, which is a multiple of 3?

Q 3. What is the probability that the drawn ball is a solid coloured and bears an even number?

Solutions

1. Total number of solid coloured balls = 8 (numbered 1 to 8)

   Total number of striped balls = 7 (numbered 9 to 15)

   ∴ Total number of possible outcomes

   = Number of solid coloured balls + Number of striped balls

   = 8 + 7 = 15

   Number of favourable outcomes

   = 1 (ball bears number 8)

   So, Required probability $= \frac{1}{15}$

2. Favourable outcomes = (2, 4, 6, 8, 10, 12, 14) *i.e.* even numbered balls.

   ∴ Number of favourable outcomes = 7

   Total possible outcomes = 15

   So, Required probability $= \frac{7}{15}$

   Or

   Favourable outcomes = (3, 6, 9, 12, 15) *i.e.*, multiple of 3 numbered balls.

   Number of favourable outcomes = 5

   Total possible outcomes = 15

   So, Required probability $= \frac{5}{15} = \frac{1}{3}$

3. Favourable outcomes = Number of solid coloured balls that have even number.

   = {2, 4, 6, 8}

   ∴ No. of favourable outcomes = 4

   Total possible outcomes = 15

   So, Required probability $= \frac{4}{15}$

Case Study 6

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.

Or

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

Q 3. 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 $= \frac{21}{25}$

Or

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

Therefore, total number of green balls + white balls

$= 4 + 8 = 12$

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

3. The number of pink balls = 8
and number of white balls = 8

$\therefore$ Total number of pink balls + white balls

$= 8 + 8 = 16$

$\therefore$ Probability of drawing either a pink ball or a white ball is $\frac{16}{25}$

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

$\therefore$ Probability of drawing neither a pink ball nor white ball

$$= 1 - \frac{16}{25} = \frac{25-16}{25} = \frac{9}{25}$$

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. If two different dice are rolled together, calculate the probability of getting an even number on both dice. *[CBSE 2015]*

Q 5. 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 6. 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 7. If a number x is chosen at random from the numbers $-3, -2, -1, 0, 1, 2, 3$, then find the probability of $x^2 < 4$. *[CBSE 2020]*

Q 8. What is the probability that a randomly taken leap year has 52 Sundays? *[CBSE 2020]*

Q 9. If a fair coin is tossed twice find the probability of getting 'at most one head'. *[CBSE 2023]*

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. A bag contains 15 balls, out of which some are white and the others are black. If the probability of drawing a black ball at random from the bag is $\frac{2}{3}$, then find how many white balls are there in the bag. *[CBSE 2019]*

Q 5. 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 6. 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 7. A game consists of tossing a coin 3 times and noting the outcome each time. If getting the same result in all the tosses is a success, find the probability of losing the game. *[CBSE 2019]*

Or

A game consist of tossing a one-rupee coin 3 times and noting the outcome each time. Ramesh will win the game if all the tosses show the same result (*i.e.*, either three heads or all three tails) and loses the game otherwise. Find the probability that Ramesh will lose the game. *[NCERT EXERCISE; CBSE 2016]*

Q 8. 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 9. Find the probability so that the number selected at random from the numbers 3, 4, 4, 4, 5, 5, 6, 6, 6, 7 will be their mean. *[CBSE 2019]*

Q 10. A number x is selected at random from the numbers 1, 2, 3 and 4. Another number y is selected at random from the numbers 1, 4, 9 and 16. Find the probability that product of x and y is less than 16. *[CBSE 2016]*

Q 11. 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. 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 2. 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 3. A bag contains 15 white and some black balls. If the probability of drawing a black ball from the bag is thrice that of drawing a white ball, find the number of black balls in the bag. *[CBSE 2017]*

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. Two dice are thrown simultaneously, what is the probability that the sum of the numbers appearing on the dice is:

(i) 9 (ii) not a prime number (iii) 1

[NCERT EXEMPLAR]

Q 6. Two different dice are thrown together. Find the probability that the numbers obtained: *[CBSE 2017]*

(i) have a sum less than 7

(ii) have a product less than 16

(iii) is a doublet of odd numbers.

Q 7. 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 8. Three unbiased coins are tossed simultaneously. Find the probability of getting:

(i) exactly 2 heads,

(ii) at least 2 heads,

(iii) at most 2 heads. *[CBSE 2015]*

Q 9. 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 10. Two different dice are thrown together. Find the probability of:

(i) getting a number greater than 3 on each dice.

(ii) getting a total 6 or 7 of the numbers on two dice.

[CBSE 2016]

Q 11. 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.

Q 12. A bag contains 18 balls out of which x balls are red.

(i) If one ball is drawn at random from the bag, what is the probability that it is not red?

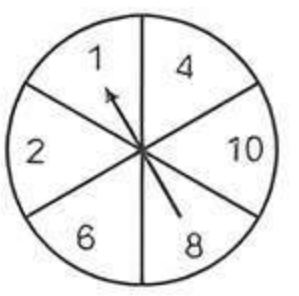
(ii) If two more red balls are put in the bag, the probability of drawing a red ball will be $\frac{9}{8}$ times the probability of drawing a red ball in the first case. Find the value of x. *[CBSE 2015]*

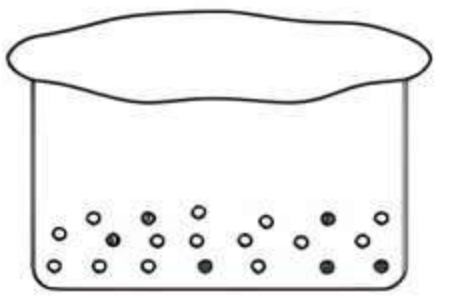
Q 13. Read the following passage and answer the questions given below it:

Diwali Fair

A game in a booth at a Diwali fair involves using a spinner first. Then, if the spinner stops on an even number, the player is allowed to pick a marble from a bag. The spinner and the marbles in the bag are represented in the figure.

Prizes are given when a black marble is picked Shweta plays the game once.





(i) What is the probability that she will be allowed to pick a marble from the bag?

(ii) Suppose she is allowed to pick a marble from the bag, what is the probability of getting a prize, when it is given that the bag contains 20 balls out of which 6 are black? *[CBSE 2020]*

Long Answer Type Questions

Q 1. Peter throws two different dice together and finds the product of the two numbers obtained. Rina throws a die and squares the number obtained. Who has the better chance to get the number 25.

[NCERT EXEMPLAR; CBSE 2017]

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]*

Q 6. A carton of 24 bulbs contain 6 defective bulbs. One bulb is drawn at random. What is the probability that the bulb is not defective? If the bulb selected is defective and it is not replaced and a second bulb is selected at random from the rest, what is the probability that the second bulb is defective?

[NCERT EXERCISE]

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

TiP

All necessary outcomes must be listed before finding probability.

   Favourable outcomes = Even numbers on both dice
   = ((2, 4), (2, 6), (4, 2), (4, 6), (6, 2), (6, 4), (2, 2), (4, 4), (6, 6))
   ∴ Total number of favourable outcomes = 9
   So, the required probability $= \frac{9}{36} = \frac{1}{4}$

5. ∵ Probability of selecting a rotten apple
   $= \frac{\text{Number of rotten apples}}{\text{Total number of apples}}$
   $\Rightarrow 0.18 = \frac{\text{Number of rotten apples}}{900}$
   ∴ Number of rotten apples = 900 × 0.18 = 162

6. 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 $= \frac{8}{90} = \frac{4}{45}$

7. Given numbers are −3, −2, −1, 0, 1, 2, 3.
   So, Total possible outcomes = 7
   Now, favourable outcomes ($x^2 < 4$) = −1, 0, 1.
   So, total number of favourable outcomes = 3.
   ∴ Probability ($x^2 < 4$)
   $= \frac{\text{Total number of favourable outcomes}}{\text{Total possible outcomes}} = \frac{3}{7}$

8. 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,
   $\text{Probability} = \frac{\text{Number of favourable outcomes}}{\text{All possible outcomes}} = \frac{5}{7}$

9. A fair coin is tossed twice, the all possible outcomes
   = {HH, HT, TH, TT}
   ∴ Number of possible outcomes = 4
   Favourable outcomes = {HT, TH, TT} as at most one head.

Number of favourable outcomes = 3

So. Required probability $= \frac{3}{4}$

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. Given, total number of balls in the bag = 15

Let the number of white balls in the bag = x

∴ The number of black balls in the bag = $15 - x$.

According to the question.

$$P(\text{drawing a black ball}) = \frac{2}{3}$$

$$\Rightarrow \quad \frac{\text{Number of black balls}}{\text{Total number of balls}} = \frac{2}{3}$$

$$\Rightarrow \quad \frac{15-x}{15} = \frac{2}{3} \Rightarrow 45 - 3x = 30$$

$$\Rightarrow \quad 3x = 15 \Rightarrow x = 5$$

Hence. the number of white balls = 5

5. 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 $= \frac{3}{36} = \frac{1}{12}$

6. 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.

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

7. Possible outcomes = {HHH. HHT. HTH. THH. HTT. THT. TTH. TTT}

Total number of possible outcomes = 8

Favourable outcomes so that Ramesh loses game = Not showing the same result on tossing a coin 3 times = {HHT. HTH. HTT. THT. TTH. THH}

Number of favourable outcomes = 6

So. probability of losing the game $= \frac{6}{8} = \frac{3}{4}$

8. 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

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

9. Given numbers are 3, 4, 4, 4, 5, 5, 6, 6, 6, 7

Here $n = 10$

∴ Number of all possible outcomes = 10

Now, mean of the given numbers

$$\overline{x} = \frac{3+4+4+4+5+5+6+6+6+7}{10}$$

$$= \frac{50}{10} = 5$$

Let E = Event of getting a mean from given numbers.

Here, the mean 5 is repeated in the given numbers two times.

So, the number of favourable outcomes = 2

∴ Required Probability, $P(E) = \frac{2}{10} = \frac{1}{5} = 0.2$

10. Total number of possible outcomes = $4 \times 4 = 16$

Favourable outcomes

(product of x and y less than 16)

= (1, 1), (1, 4), (1, 9), (2, 1), (2, 4), (3, 1), (3, 4), (4, 1)

Number of favourable outcomes = 8

So, the required probability $= \frac{8}{16} = \frac{1}{2}$

COMMON ERR(!)R

Mostly, students commit the error in finding the favourable outcomes.

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

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

Short Answer Type-II Questions

1. (i) Total number of outcomes = $2 \times 2 = 4$

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) $= \frac{2}{4} = \frac{1}{2}$

2. 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

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

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

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

3. Let number of black balls in the bag be x.

∴ Total number of balls in the bag

= 15 white + x black = $(15 + x)$

When a ball is drawn at random from the bag,

Total possible outcomes = $(15 + x)$

Number of favourable outcomes of drawing a white ball = 15

∴ P(drawing a white ball)

$$= \frac{\text{Number of favourable outcomes}}{\text{Number of possible outcomes}} = \frac{15}{15+x}$$

Then, P(drawing a black ball)

= 1 – P(drawing a white ball)

$$= 1 - \frac{15}{15+x} = \frac{x}{15+x} \qquad (\because P(E) + P(\bar{E}) = 1)$$

According to the question,

P(drawing a black ball) = 3 × P(drawing a white ball)

$$\Rightarrow \quad \frac{x}{15+x} = 3 \times \frac{15}{15+x}$$

$$\Rightarrow \quad x = 45 \qquad [\because x \neq -15]$$

So, required number of black balls in the bag is 45.

4. (i) Total number of cards = 5

Total number of queens = 1

∴ 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

∴ P(getting an ace) $= \frac{1}{4}$

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

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

5. Total number of possible outcomes $= 6 \times 6 = 36$

(I) Favourable outcomes (sum of numbers appearing on the dice is 9) = {(3,6), (4,5), (5,4), (6,3)}

Number of favourable outcomes = 4

So, probability of getting sum of numbers on the dice is 9

$$= \frac{4}{36} = \frac{1}{9}$$

(ii) Favourable outcomes (sum of the numbers on the dice is a prime number, *i.e.*, 2, 3, 5, 7, 11)

= {(1, 1), (1, 2), (2, 1), (1, 4), (4, 1), (1, 6), (6, 1), (2, 5), (5, 2), (5, 6), (6, 5), (3, 2), (2, 3), (3, 4), (4, 3)}

Number of favourable outcomes = 15

So, probability of getting sum of the numbers on dice as a prime number $= \frac{15}{36} = \frac{5}{12}$

Hence, the probability of getting sum of the numbers on dice is not a prime number

$$= 1 - \frac{5}{12} = \frac{7}{12}$$

(iii) Since the sum of two numbers on two dice cannot be less than 2, so the sum of the numbers appearing on the dice as 1 is not possible. Hence, the probability is zero.

6. All possible outcomes when two dice are thrown together

= {(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)}

∴ Number of all possible outcomes $= 6 \times 6 = 36$

(I) Favourable events (have a sum < 7)

= {(1, 1), (1, 2), (1, 3), (1, 4), (1, 5), (2, 1),
(2, 2), (2, 3), (2, 4), (3, 1), (3, 2), (3, 3),
(4, 1), (4, 2), (5, 1)}

∴ Number of favourable events = 15

So, P(have a sum less than 7) $= \frac{15}{36} = \frac{5}{12}$

(II) Favourable events (have a product < 16)

= {(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),
(4, 1), (4, 2), (4, 3), (5, 1), (5, 2), (5, 3)
(6, 1), (6, 2) }

∴ Number of favourable events = 25

So, $\bar{P}$(have a product less than 16) $= \frac{25}{36}$

(III) Favourable events (is a doublet of odd numbers)
{(1, 1), (3, 3), (5, 5)}

∴ Number of favourable events = 3

So, $\bar{P}$(is a doublet of odd numbers) $= \frac{3}{36} = \frac{1}{12}$

7. 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 $= 140 - 74 = 66$

∴ 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 $= \frac{17}{100}$.

8. Total Possible outcomes = {HHH, HHT, HTH, THH, HTT, THT, TTH, TTT}

Total number of possible outcomes = 8

(I) Favourable outcomes (exactly 2 heads)

= {HHT, HTH, THH}

Number of favourable outcomes = 3

So, probability of getting exactly 2 heads $= \frac{3}{8}$

(II) Favourable outcomes (at least 2 heads, *i.e.*, 2 heads or 3 heads) = {HHT, HTH, THH,HHH}

Number of favourable outcomes = 4

So, probability of getting at least 2 heads $= \frac{4}{8}$

$= \frac{1}{2}$

(iii) Favourable outcomes (at most 2 heads) (*i.e.*, 0 head or 1 head or 2 heads) = {HHT, HTH, HTT, THH, THT, TTH, TTT}

Number of favourable outcomes = 7

So, probability of getting at most 2 heads $= \frac{7}{8}$

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

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

∴ 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 $= 1 - \frac{4}{5} = \frac{1}{5}$

10. Total possible outcomes = $6 \times 6 = 36$

(i) Favourable outcomes = Getting number greater than 3 on each dice = {(4, 4), (4, 5), (4, 6) (5, 4), (5, 5), (5, 6), (6, 4), (6, 5), (6, 6)}

Total number of favourable outcomes = 9

So, probability of getting a number greater than 3 on each dice $= \frac{9}{36} = \frac{1}{4}$

(ii) Favourable outcomes = Getting a total 6 or 7 of the numbers on two dice = {(3, 3), (3, 4), (2, 4), (1, 5), (1, 6), (2, 5), (4, 2), (4, 3), (5, 1), (5, 2), (6, 1)}.

Total number of favourable outcomes = 11

So, probability of getting a total 6 or 7 on two dice $= \frac{11}{36}$

11. Total number of cards = 52

Total number of cards removed = 2 + 2 = 4

∴ 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.

12. (I) Total number of balls = 18

So, total number of possible outcomes = 18

Let number of red balls be x.

Number of balls which are not red = $18 - x$

So, probability of getting a ball which is not red $= \frac{18 - x}{18}$

(II) Two more red balls are put in the bag, so total numbers of balls now = 18 + 2 = 20

Number of red balls now $= x + 2$

According to given question,

Probability of getting a red ball now

$= \frac{9}{8} \times$ Probability of getting a red ball in first case

$\therefore \quad \frac{x+2}{20} = \frac{9}{8} \times \frac{x}{18}$

$\Rightarrow \quad \frac{x+2}{20} = \frac{x}{16} \Rightarrow 16(x+2) = 20x$

$\Rightarrow \quad 16x + 32 = 20x$

$\Rightarrow \quad 20x - 16x = 32$

$\Rightarrow \quad 4x = 32 \Rightarrow x = \frac{32}{4} = 8$

Hence, $x = 8$

13. (I) Shweta will be allowed to pick up a marble, only when the spinner stops on an even number.

Total possible outcomes = Numbers on spinner = 6

Favourable outcomes = even numbers = {2, 4, 6, 8, 10}

Total number of favourable outcomes = 5

So, P(getting an even number) $= \frac{5}{6}$

(II) Total possible outcomes = Number of marbles in a bag = 20

Total Number of favourable outcomes = Number of black balls = 6

∴ P(getting a black marble) $= \frac{6}{20} = \frac{3}{10}$

So, probability of getting a prize is $\frac{3}{10}$.

Long Answer Type Questions

1. Peter throws two different dice.

∴ Total number of possible outcomes = $6 \times 6 = 36$

Favourable outcomes of getting a product 25

= only 5×5

∴ Number of favourable outcomes of getting a product 25 = 1

Therefore, probability for Peter

$= \frac{\text{Number of favourable outcomes}}{\text{Total number of possible outcomes}} = \frac{1}{36}$

Now, Rina throws a die.

∴ Total number of possible outcomes = 6

Favourable outcomes of getting a square 25 = only 5^2

∴ Number of favourable outcomes of getting a square 25 = 1

Therefore, probability for Rina

$= \frac{\text{Number of favourable outcomes}}{\text{Total number of possible outcomes}} = \frac{1}{6} = \frac{6}{36}$

Hence, Rina has better chance of getting 25.

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

∴ 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

TR!CK

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 ERR!R

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 ERR!RS

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}

TR!CK

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}

TR!CK

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

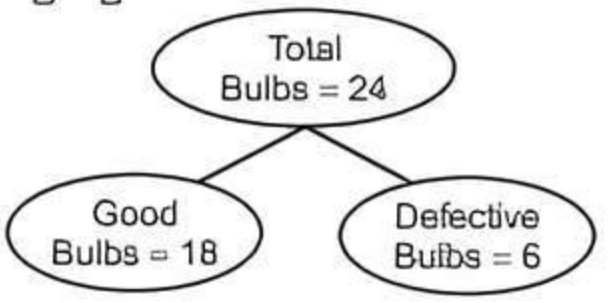
6. Total number of bulbs = 24

Non-defective bulbs $24 - 6 = 18$

Defective bulbs = 6

Let E_1 be the event of selecting a non-defective bulb.

i.e., selecting a good bulb.



Number of favourable outcomes = 18

∴ Probability that bulb is non-defective.

$$P(E) = \frac{18}{24} = \frac{3}{4}$$

Suppose, the selected bulb is defective and not replaced, then total number of bulbs remaining in the carton = 23

i.e., total remaining bulb = 23

Out of them, 18 are good bulbs and 5 are defective

∴ P(selecting second defective bulb) $= \frac{5}{23}$

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 experiment cannot exceed .....

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 .....

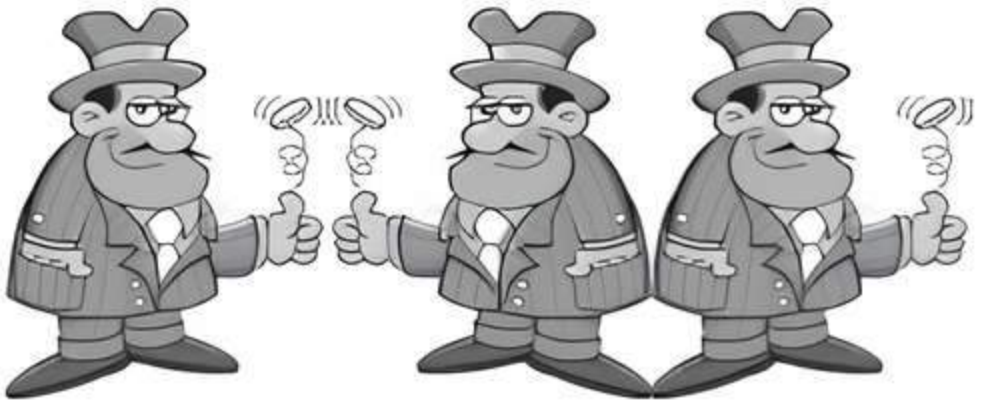
True/False

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

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

Case Study Based Question

Q 9. Three persons toss 3 coins simultaneously and note the outcomes. Then, they ask few questions to one another.



Based on the above information, solve the following questions:

(i) Find the probability of getting at most one tail.

(ii) Find the probability of getting at most 3 heads.

Or

Find the probability of getting at least two heads.

(iii) Find the probability of getting exactly 3 tails.

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. A number x is chosen at random from $-4, -3, -2, -1, 0, 1, 2, 3, 4$. Find the probability that $|x| \leq 4$.

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:

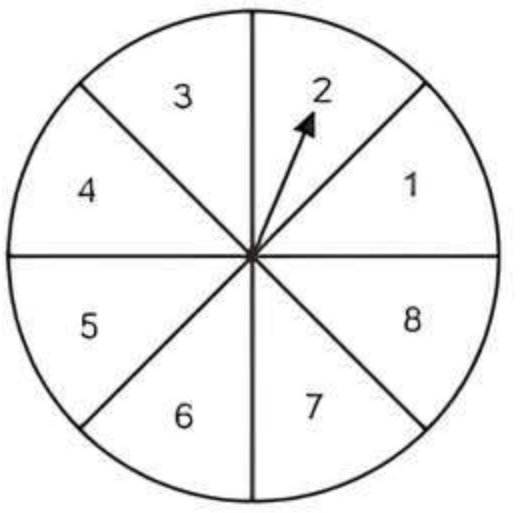
(i) vowel, (ii) consonant

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.