Probability

CHAPTER 15

NCERT FOCUS

SOLUTIONS

EXERCISE - 15.1

1. (i) Probability of an event E + Probability of the event 'not E' = 1.

(ii) The probability of an event that cannot happen is 0. Such an event is called impossible event.

(iii) The probability of an event that is certain to happen is 1. Such an event is called sure or certain event.

(iv) The sum of the probabilities of all the elementary events of an experiment is 1.

(v) The probability of an event is greater than or equal to 0 and less than or equal to 1.

2. (i) Since the driver may or may not start the car, thus the outcomes are not equally likely.

(ii) The player may shoot or miss the shot.

∴ The outcomes are not equally likely.

(iii) In advance it is known that the answer is to be either right or wrong.

∴ The outcomes right or wrong are equally likely to occur.

(iv) In advance it is known that newly born baby has to be either a boy or a girl.

∴ The outcomes either a boy or a girl are equally likely to occur.

3. Since on tossing a coin, the outcomes 'head' and 'tail' are equally likely, the result of tossing a coin is completely unpredictable and so it is a fair way.

4. **(b) :** Since, the probability of an event cannot be negative.

∴ –1.5 cannot be the probability of an event.

5. ∵ $P(E) + P(\text{not } E) = 1$

∴ $0.05 + P(\text{not } E) = 1 \Rightarrow P(\text{not } E) = 1 - 0.05 = 0.95$

Thus, probability of 'not E' = 0.95.

6. (i) Since there are lemon flavoured candies only in the bag.

∴ Taking out orange flavoured candy is not possible.

⇒ Probability of taking out an orange flavoured candy = 0.

(ii) Probability of taking out a lemon flavoured candy = 1.

7. Let the probability of 2 students having same birthday = $P(SB)$

And the probability of 2 students not having the same birthday = $P(NSB)$

∴ $P(SB) + P(NSB) = 1$

⇒ $P(SB) + 0.992 = 1 \Rightarrow P(SB) = 1 - 0.992 = 0.008$

8. Total number of balls = 3 + 5 = 8

∴ Number of possible outcomes = 8

(i) ∵ There are 3 red balls.

⇒ Number of favourable outcomes = 3

∴ $P(\text{red ball}) = \dfrac{\text{Number of favourable outcomes}}{\text{Number of all possible outcomes}} = \dfrac{3}{8}$

(ii) Probability of the ball drawn which is not red

$= 1 - P(\text{red ball}) = 1 - \dfrac{3}{8} = \dfrac{8-3}{8} = \dfrac{5}{8}$.

9. Total number of marbles = 5 + 8 + 4 = 17

∴ Number of all possible outcomes = 17

(i) ∵ Number of red marbles = 5

⇒ Number of favourable outcomes = 5

∴ Probability of red marbles, $P(\text{red}) = \dfrac{5}{17}$

(ii) ∵ Number of white marbles = 8

⇒ Number of favourable outcomes = 8

∴ Probability of white marbles, $P(\text{white}) = \dfrac{8}{17}$

(iii) ∵ Number of green marbles = 4

∴ Number of marbles which are not green = 17 – 4 =13

⇒ Number of favourable outcomes = 13

∴ Probability of marbles 'not green', $P(\text{not green}) = \dfrac{13}{17}$

10. Number of : 50 p coins = 100, ₹ 1 coins = 50

₹ 2 coins = 20, ₹ 5 coins = 10

Total number of coins = 100 + 50 + 20 + 10 = 180

∴ Total possible outcomes = 180

(i) Number of favourable outcomes = 100

∴ $P(50\text{ p coins}) = \dfrac{100}{180} = \dfrac{5}{9}$

(ii) Number of ₹ 5 coins = 10

∴ Number of 'not ₹ 5' coins = 180 – 10 = 170

⇒ Number of favourable outcomes = 170

∴ $P(\text{not ₹ 5 coin}) = \dfrac{170}{180} = \dfrac{17}{18}$

11. Number of male fishes = 5

Number of female fishes = 8

∴ Total number of fishes = 5 + 8 = 13

⇒ Total number of outcomes = 13

∴ $P(\text{fish taken out is a male fish}) = 5/13$.

12. Total number marked = 8

∴ Total number of possible outcomes = 8

(i) Number of favourable outcomes = 1

∴ $P(8) = \dfrac{\text{Number of favourable outcomes}}{\text{Total number of possible outcomes}} = \dfrac{1}{8}$

(ii) Odd numbers are 1, 3, 5 and 7.

$\therefore$ Number of odd numbers from 1 to 8 = 4

$\Rightarrow$ Number of favourable outcomes = 4

$\therefore$ P (an odd number)

$$= \frac{\text{Number of favourable outcomes}}{\text{Total number of possible outcomes}} = \frac{4}{8} = \frac{1}{2}$$

(iii) The numbers 3, 4, 5, 6, 7 and 8 are greater than 2.

$\therefore$ Number of numbers greater than 2 = 6

$\Rightarrow$ Number of favourable outcomes = 6

$\therefore$ P(a number greater than 2)

$$= \frac{\text{Number of favourable outcomes}}{\text{Total number of possible outcomes}} = \frac{6}{8} = \frac{3}{4}$$

(iv) The numbers 1, 2, 3, 4, 5, 6, 7 and 8 are less than 9.

$\therefore$ Number of numbers less than 9 = 8

$\Rightarrow$ Number of favourable outcomes = 8

$\therefore$ P(a number less than 9)

$$= \frac{\text{Number of favourable outcomes}}{\text{Total number of possible outcomes}} = \frac{8}{8} = 1$$

13. Since, numbers on a die are 1, 2, 3, 4, 5 and 6.

$\therefore$ Number of total possible outcomes = 6

(i) Since 2, 3 and 5 are prime numbers.

$\Rightarrow$ Number of favourable outcomes = 3

P(a prime number)

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

(ii) Since, the numbers between 2 and 6 are 3, 4 and 5.

$\Rightarrow$ Number of favourable outcomes = 3

$\therefore$ P(a number lying between 2 and 6)

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

(iii) Since 1, 3 and 5 are odd numbers.

$\Rightarrow$ Number of favourable outcomes = 3

$\therefore$ P(an odd number)

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

14. Number of cards in deck = 52

$\therefore$ Total number of possible outcomes = 52

(i) $\because$ Number of red colour kings = 2

[$\because$ King of diamond and heart is red]

$\Rightarrow$ Number of favourable outcomes = 2

$$\therefore\ P(\text{a red king}) = \frac{\text{Number of favourable outcomes}}{\text{Total number of possible outcomes}} = \frac{2}{52} = \frac{1}{26}$$

(ii) $\because$ 4 kings, 4 queens and 4 jacks are face cards.

$\therefore$ Number of face cards = 12

$\Rightarrow$ Number of favourable outcomes = 12

$$\therefore\ P(\text{a face card}) = \frac{\text{Number of favourable outcomes}}{\text{Total number of possible outcomes}} = \frac{12}{52} = \frac{3}{13}$$

(iii) Since, cards of diamond and heart are red.

$\therefore$ There are 2 kings, 2 queens, 2 jacks *i.e.,* 6 cards are red face cards.

$\Rightarrow$ Number of favourable outcomes = 6

$$\therefore\ P(\text{red face card}) = \frac{\text{Number of favourable outcomes}}{\text{Total number of possible outcomes}} = \frac{6}{52} = \frac{3}{26}$$

(iv) Since, there is only 1 jack of hearts.

$\Rightarrow$ Number of favourable outcomes = 1

$\therefore$ P(jack of hearts)

$$= \frac{\text{Number of favourable outcomes}}{\text{Total number of possible outcomes}} = \frac{1}{52}$$

(v) $\because$ There are 13 spades in a pack of 52 cards.

$\Rightarrow$ Number of favourable outcomes = 13

$$\therefore\ P(\text{a spade}) = \frac{\text{Number of favourable outcomes}}{\text{Total number of possible outcomes}} = \frac{13}{52} = \frac{1}{4}$$

(vi) $\because$ There is only one queen of diamonds.

$\Rightarrow$ Number of favourable outcomes = 1

$\therefore$ P(a queen of diamonds)

$$= \frac{\text{Number of favourable outcomes}}{\text{Total number of possible outcomes}} = \frac{1}{52}$$

15. We have five cards.

$\therefore$ Total number of possible outcomes = 5

(i) $\because$ Number of queens = 1

$\Rightarrow$ Number of favourable outcomes = 1

$$\therefore\ P(\text{a queen}) = \frac{\text{Number of favourable outcomes}}{\text{Total number of possible outcomes}} = \frac{1}{5}$$

(ii) The queen is drawn and put aside.

$\Rightarrow$ Only 5 – 1 = 4 cards are left.

$\therefore$ Total number of possible outcomes = 4

(a) $\because$ There is only one ace.

$\Rightarrow$ Number of favourable outcomes = 1

$$\therefore\ P(\text{an ace}) = \frac{\text{Number of favourable outcomes}}{\text{Total number of possible outcomes}} = \frac{1}{4}$$

(b) Since, the only queen has already been put aside.

$\Rightarrow$ Number of possible outcomes = 0

$\therefore$ P(a queen)

$$= \frac{\text{Number of favourable outcomes}}{\text{Total number of possible outcomes}} = \frac{0}{4} = 0$$

16. We have, number of good pens = 132 and number of defective pens = 12

$\Rightarrow$ Total number of possible outcomes = 132 + 12 = 144

$\Rightarrow$ Number of favourable outcomes = 132

$\therefore$ P(good pens)

$$= \frac{\text{Number of favourable outcomes}}{\text{Total number of possible outcomes}} = \frac{132}{144} = \frac{11}{12}$$

17. (i) Since, there are 20 bulbs in the lot.

$\Rightarrow$ Total number of possible outcomes = 20

$\because$ Number of defective bulbs = 4

$\Rightarrow$ Number of favourable outcomes = 4

$\therefore$ P(defective bulb)

$$= \frac{\text{Number of favourable outcomes}}{\text{Total number of possible outcomes}} = \frac{4}{20} = \frac{1}{5}$$

(ii) $\because$ The bulb drawn above is not included in the lot.
$\therefore$ Number of remaining bulbs = 20 – 1 = 19
$\Rightarrow$ Total number of possible outcomes = 19
$\because$ Number of bulbs which are not defective
= 19 – 4 = 15
$\Rightarrow$ Number of favourable outcomes = 15
$\therefore$ P(not defective bulb)

$$= \frac{\text{Number of favourable outcomes}}{\text{Total number of possible outcomes}} = \frac{15}{19}$$

18. We have, total number of discs = 90
$\therefore$ Total number of possible outcomes = 90
(i) Since the two-digit numbers are 10, 11, 12, ..., 90.
$\therefore$ Number of two-digit numbers = 90 – 9 = 81
$\Rightarrow$ Number of favourable outcomes = 81
$\therefore$ P(a two-digit number)

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

(ii) Perfect square numbers from 1 to 90 are 1, 4, 9, 16, 25, 36, 49, 64 and 81.
$\therefore$ Number of perfect squares = 9
$\Rightarrow$ Number of favourable outcomes = 9
$\therefore$ P(a perfect square number)

$$= \frac{\text{Number of favourable outcomes}}{\text{Total number of possible outcomes}} = \frac{9}{90} = \frac{1}{10}$$

(iii) Numbers divisible by 5 from 1 to 90 are 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90
i.e., There are 18 numbers from 1 to 90 which are divisible by 5.
$\Rightarrow$ Number of favourable outcomes = 18
$\therefore$ P(a number divisible by 5)

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

19. Since there are six faces of the given die and these faces are marked with letters A, B, C, D, E and A.
$\therefore$ Total number of letters = 6
$\Rightarrow$ Total number of possible outcomes = 6
(i) $\because$ Two faces are having the letter A.
$\Rightarrow$ Number of favourable outcomes = 2
$\therefore$ P(getting letter A)

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

(ii) $\because$ Only one face is having the letter D.
$\Rightarrow$ Number of favourable outcomes = 1
$\therefore$ P(getting letter D)

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

20. Here, area of the rectangle = 3 m × 2 m = 6 m^2

And, the area of the circle $= \pi r^2 = \pi\left(\frac{1}{2}\right)^2 \text{m}^2 = \frac{\pi}{4}\text{m}^2$

$\therefore$ Probability for the die to fall inside the circle

$$= \frac{\text{Area of the favourable region}}{\text{Area of the whole region}}$$

$$= \frac{\text{Area of the circle}}{\text{Area of the rectangle}} = \frac{\left[\frac{\pi}{4}\right]}{6} = \frac{\pi}{4} \times \frac{1}{6} = \frac{\pi}{24}$$

21. Total number of ball pens = 144
$\Rightarrow$ Total number of possible outcomes = 144
(i) Since there are 20 defective pens.
$\therefore$ Number of good pens = 144 – 20 = 124
$\Rightarrow$ Number of favourable outcomes = 124
$\therefore$ Probability that she will buy it $= \frac{124}{144} = \frac{31}{36}$
(ii) Probability that she will not buy it
= 1 – [Probability that she will buy it]

$$= 1 - \frac{31}{36} = \frac{36-31}{36} = \frac{5}{36}$$

22. $\because$ The two dice are thrown together.
$\therefore$ Following are the possible outcomes :
{(1, 1) , (1, 2), (1, 3), (1, 4), (1, 5), (1, 6), (2, 1) , (2, 2), (2, 3), (2, 4), (2, 5), (2, 6), (3, 1) , (3, 2), (3, 3), (3, 4), (3, 5), (3, 6), (4, 1) , (4, 2), (4, 3), (4, 4), (4, 5), (4, 6), (5, 1) , (5, 2), (5, 3), (5, 4), (5, 5), (5, 6), (6, 1) , (6, 2), (6, 3), (6, 4), (6, 5), (6, 6)}.
$\Rightarrow$ Total number of possible outcomes = 6 × 6 = 36
(i) (a) $\because$ The sum on two dice is 3 for: (1, 2) and (2, 1)
$\therefore$ Number of favourable outcomes = 2 $\Rightarrow$ P(3) = 2/36
(b) $\because$ The sum on two dice is 4 for :
(1, 3), (2, 2) and (3, 1).
$\therefore$ Number of favourable outcomes = 3 $\Rightarrow$ P(4) = 3/36
(c) $\because$ The sum on two dice is 5 for :
(1, 4), (2, 3), (3, 2) and (4, 1)
$\therefore$ Number of favourable outcomes = 4 $\Rightarrow$ P(5) = 4/36
(d) $\because$ The sum on two dice is 6 for :
(1, 5), (2, 4), (3, 3), (4, 2) and (5, 1)
$\therefore$ Number of favourable outcomes = 5 $\Rightarrow$ P(6) = 5/36
(e) $\because$ The sum on two dice is 7 for :
(1, 6), (2, 5), (3, 4), (4, 3), (5, 2) and (6, 1)
$\therefore$ Number of favourable outcomes = 6 $\Rightarrow$ P(7) = 6/36
(f) $\because$ The sum on two dice is 9 for :
(3, 6), (4, 5), (5, 4) and (6, 3)
$\therefore$ Number of favourable outcomes = 4 $\Rightarrow$ P(9) = 4/36
(g) $\because$ The sum on two dice is 10 for :
(4, 6), (5, 5) and (6, 4)
$\therefore$ Number of favourable outcomes = 3 $\Rightarrow$ P(10) = 3/36
(h) $\because$ The sum on two dice is 11 for : (5, 6) and (6, 5)
$\therefore$ Number of favourable outcomes = 2 $\Rightarrow$ P(11) = 2/36
Thus, the complete table is as under:

Event: 'Sum on 2 dice'	Probability
2	1/36
3	2/36
4	3/36
5	4/36
6	5/36
7	6/36
8	5/36
9	4/36
10	3/36
11	2/36
12	1/36

(ii) No, the number of all possible outcomes is 36 not 11.

∴ The argument is not correct.

23. All the possible outcomes are:
{HHH, HHT, HTT, TTT, TTH, THT, THH, HTH}

∴ Number of all possible outcomes = 8

Let the event that Hanif will lose the game be denoted by E.

∴ Favourable outcomes are:
{HHT, HTH, THH, THT, TTH, HTT}

⇒ Number of favourable outcomes = 6

∴ $P(E) = \frac{6}{8} = \frac{3}{4}$

24. Since, throwing a die twice or throwing two dice simultaneously is the same.

∴ All possible outcomes are:
{(1, 1), (1, 2), (1, 3), (1, 4), (1, 5), (1, 6), (2, 1), (2, 2), (2, 3), (2, 4), (2, 5), (2, 6), (3, 1), (3, 2), (3, 3), (3, 4), (3, 5), (3, 6), (4, 1), (4, 2), (4, 3), (4, 4), (4, 5), (4, 6), (5, 1), (5, 2), (5, 3), (5, 4), (5, 5), (5, 6), (6, 1), (6, 2), (6, 3), (6, 4), (6, 5), (6, 6)}

∴ Total number of possible outcomes = 36

(i) Let E be the event that 5 does not come up either time.

Number of favourable outcomes = [36 – (5 + 6)] = 25

∴ $P(E) = \frac{25}{36}$

(ii) Let N be the event that 5 will come up at least once, then number of favourable outcomes = 5 + 6 = 11

∴ $P(N) = \frac{11}{36}$

25. (i) Given argument is not correct. Because, if two coins are tossed simultaneously then four outcomes are possible {HH, HT, TH, TT}. So total number of outcomes is 4.

∴ The probability of each of these outcomes = 1/4.

(ii) Correct. Because the two outcomes are possible. Total number of outcomes = 6 and odd numbers = 3 and even numbers = 3.

So, number of favourable outcomes = 3 (in both the cases even or odd).

∴ $P(\text{getting an odd number}) = \frac{3}{6} = \frac{1}{2}$

EXERCISE - 15.2

1. Here, total number of possible outcomes = $5 \times 5 = 25$

(i) Outcomes for both customers visiting on same day are :
{(Tue., Tue.), (Wed., Wed.), (Thu., Thu.), (Fri., Fri.), (Sat., Sat.)}

Number of favourable outcomes = 5

∴ Required probability $= \frac{5}{25} = \frac{1}{5}$

(ii) Outcomes for both the customers visiting on consecutive days are :
{(Tue., Wed.), (Wed., Thu.), (Thu., Fri.), (Fri., Sat.), (Sat., Fri.), (Wed., Tue.), (Thu., Wed.), (Fri., Thu.)}

⇒ Number of favourable outcomes = 8

∴ Required probability $= \frac{8}{25}$

(iii) We have probability for both visiting on same day $= \frac{1}{5}$

∴ Probability for both visiting on different days
= 1 – [Probability for both visiting on the same day]

$= 1 - \frac{1}{5} = \frac{5-1}{5} = \frac{4}{5}$

∴ The required probability $= \frac{4}{5}$.

2. The completed table is as under:

+	1	2	2	3	3	6
1	2	3	3	4	4	7
2	3	4	4	5	5	8
2	3	4	4	5	5	8
3	4	5	5	6	6	9
3	4	5	5	6	6	9
6	7	8	8	9	9	12

∴ Number of all possible outcomes = 36

(i) For total score being even :

Favourable outcomes = 18

[∵ The even outcomes are: 2, 4, 4, 4, 4, 8, 4, 4, 8, 4, 6, 6, 4, 6, 6, 8, 8, 12]

∴ The required probability $= \frac{18}{36} = \frac{1}{2}$

(ii) For the total score being 6 :

In list of scores, we have four 6's.

∴ Number of favourable outcomes = 4

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

(iii) For the total score being at least 6:

The favourable scores are : 7, 8, 8, 6, 6, 9, 6, 6, 9, 7, 8, 8, 9, 9 and 12

⇒ Number of favourable outcomes = 15

∴ Required probability $= \frac{15}{36} = \frac{5}{12}$

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

∴ Total number of balls = $x + 5$

Number of possible outcomes = $(x + 5)$

For a blue ball, number of favourable outcomes = x

∴ Probability of drawing a blue ball $= \frac{x}{x+5}$

Similarly, probability of drawing a red ball $= \frac{5}{x+5}$

Now, we have $\frac{x}{x+5} = 2\left[\frac{5}{x+5}\right]$

⇒ $\frac{x}{x+5} = \frac{10}{x+5} \Rightarrow x = 10$

Thus, the required number of blue balls is 10.

4. $\because$ The total number of balls in the box = 12
$\therefore$ Total number of possible outcomes = 12
Case I: For drawing a black ball
Number of favourable outcomes = x
$\therefore$ Probability of getting a black ball $= \frac{x}{12}$
Case II: When 6 more black balls are added
Now, the total number of balls = 12 + 6 = 18
$\Rightarrow$ Total number of possible outcomes = 18
Now, the number of black balls = $(x + 6)$.
$\therefore$ Number of favourable outcomes = $(x + 6)$
$\therefore$ Required probability $= \frac{x+6}{18}$
According to the given condition,

$$\frac{x+6}{18} = 2\left(\frac{x}{12}\right)$$

$\Rightarrow$ $12(x + 6) = 36x \Rightarrow 12x + 72 = 36x$
$\Rightarrow$ $36x - 12x = 72 \Rightarrow 24x = 72 \Rightarrow x = \frac{72}{24} = 3$
Thus, the required value of x is 3.

5. $\because$ There are 24 marbles in the jar.
$\therefore$ Total number of possible outcomes = 24
Let there are x blue marbles in the jar.
$\therefore$ Number of green marbles = $24 - x$
$\Rightarrow$ Number of favourable outcomes = $(24 - x)$
$\therefore$ Required probability for drawing a green marble
$= \frac{24-x}{24}$
Now, according to the condition, we have $\frac{24-x}{24} = \frac{2}{3}$
$\Rightarrow$ $3(24 - x) = 2 \times 24 \Rightarrow 72 - 3x = 48$
$\Rightarrow$ $3x = 72 - 48 \Rightarrow 3x = 24 \Rightarrow x = \frac{24}{3} = 8$
Thus, the required number of blue marbles is 8.