NCERT Solutions of Chapter 15 - Probability

Ex 15.1

Question 1.

Complete the following statements:

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

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

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

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

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

Solution:

(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 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**.

Question 2.

Which of the following experiments have equally likely outcomes? Explain.

(i) A driver attempts to start a car. The car starts or does not start.

(ii) A player attempts to shoot a basketball. She/he shoots or misses the shot.

(iii) A trial is made to answer a true-false question. The answer is right or wrong.

(iv) A baby is born. It is a boy or a girl.

Solution:

(i) The outcome is not equally likely because the car starts normally only when there is some defect, the car does not start.

(ii) The outcome is not equally likely because the outcome depends on the training of the player.

(iii) The outcome in the trial of true-false question is, either true or false. Hence, the two outcomes are equally likely.

(iv) A baby can be either a boy or a girl and both the outcomes have equally likely chances.

Question 3.
Why is tossing a coin considered to be a fair way of deciding which team should get the bail at the beginning of a football game?
Solution:
When we toss a coin, the outcomes head and tail are equally likely. So, the result of an individual coin toss is completely unpredictable.

Question 4.
Which of the following cannot be the probability of an event?
(A) $\frac{2}{3}$
(B) -1.5
(C) 15%
(D) 0.7
Solution:
We know that probability of an event cannot be less than 0 and greater than 1.
Correct option is **(B)**.

Question 5.
If P (E) = 0.05, what is the probability of 'not E'?
Solution:
We have, P (E) + P (not E) = 1
Given: P(E) = 0.05
P (not E) = 1 – 0.05 = 0.95

Question 6.
A bag contains lemon flavoured candies only. Malini takes out one candy without looking into the bag. What is the probability that she takes out
(i) an orange flavoured candy?
(ii) a lemon flavoured candy?
Solution:
(i) A bag contains only lemon flavoured candies.
P (an orange flavoured candy) = 0
(ii) P (a lemon flavoured candy) = 1

Question 7.
It is given that in a group of 3 students, the probability of 2 students not having the same birthday is 0.992. What is the probability that the 2 students have the same birthday?
Solution:
We have, P (E) + P (not E) = 1
$\Rightarrow$ P (E) + 0.992 = 1
$\Rightarrow$ P (E) = 1 – 0.992 = 0.008

Question 8.
A bag contains 3 red balls and 5 black balls. A ball is drawn at random from the bag. What is the probability that the ball drawn is
(i) red?
(ii) not red?
Solution:
Number of red balls = 3
Number of black balls = 5
Total number of balls = 3 + 5 = 8

$$(i)\ \text{P (red ball)} = \frac{\text{Number of red balls}}{\text{Total number of balls}} = \frac{3}{8}$$

$$(ii)\ \text{P (not red)} = 1 - \frac{3}{8} = \frac{5}{8}$$

Question 9.
A box contains 5 red marbles, 8 white marbles and 4 green marbles. One marble is taken out of the box at random. What is the probability that the marble taken out will be
(i) red?
(ii) white?
(iii) not green?
Solution:
Total number of marbles = 5 + 8 + 4 = 17
(i) P (red marble) = 517
(ii) P (white marble) = 817
(iii) P (not a green marble) = 1317

Question 10.
A piggy bank contains hundred 50 p coins, fifty ₹ 1 coins, twenty ₹ 2 coins and ten ₹ 5 coins. If it is equally likely that one of the coins will fall out when the bank is turned upside down, what is the probability that the coin
(i) will be a 50 p coin?
(ii) will not be a ₹ 5 coin?
Solution:
Number of 50 p coins = 100
Number of ₹ 1 coins = 50
Number of ₹ 2 coins = 20
Number of ₹ 5 coins = 10

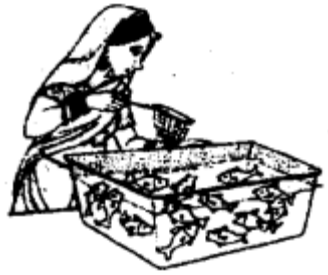
Total number of coins = 180

(i) P (50 p coin) $= \frac{100}{180} = \frac{5}{9}$

(ii) P (not a ₹ 5 coin) $= 1 - \frac{10}{180} = \frac{170}{180} = \frac{17}{18}$

Question 11.

Gopi buys a fish from a shop for his aquarium. The shopkeeper takes out one fish at random from a tank containing 5 male fish and 8 female fish (see figure). What is the probability that the fish taken out is a male fish?



Solution:

Number of male fish = 5

Number of female fish = 8

Total number of fish = 5 + 8 = 13

P (a male fish) = 513

Question 12.

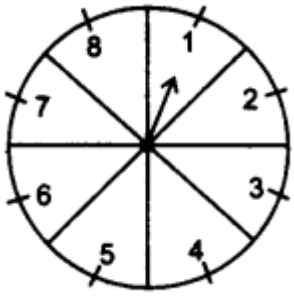
A game of chance consists of spinning an arrow which comes to rest pointing at one of the numbers 1, 2, 3, 4, 5, 6, 7, 8 (see figure.), and these are equally likely outcomes. What is the probability that it will point at

(i) 8?

(ii) an odd number?

(iii) a number greater than 2?

(iv) a number less than 9?



Solution:

(i) P (getting 8) = 18

(ii) P (an odd number) = 48 = 12 (odd numbers are 1, 3, 5, 7)

(iii) P (a number greater than 2) = $68 = 34$
(iv) P (a number less than 9) = $88 = 1$

Question 13.
A die is thrown once. Find the probability of getting
(i) a prime number
(ii) a number lying between 2 and 6
(ill) an odd number
Solution:
(i) Prime numbers on a die = 2, 3, 5
P (a prime number) = $36 = 12$
(ii) Number lying between 2 and 6 = 3, 4, 5
P(a number lying between 2 and 6) = $36 = 12$
(iii) Odd numbers = 1, 3, 5
P (an odd number) = $36 = 12$

Question 14.
One card is drawn from a well-shuffled deck of 52 cards. Find the probability of getting
(i) a king of red colour
(ii) a face card
(iii) a red face card
(iv) the jack of hearts
(v) a spade
(vi) the queen of diamonds
Solution:
Number of cards in a well-shuffled deck = 52.
(i) P (a king of red colour) = $252 = 126$
(ii) P (a face card) = $1252 = 313$
(iii) P (a red face card) = $652 = 326$
(iv) P (the jack of hearts) = 152
(v) P(a spade) = $1352 = 14$
(vi) P (the queen of diamonds) = 152

Question 15.
Five cards – the 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?
Solution:
Out of 5 cards there is only one queen.
(i) P (getting queen) = 15 [when queen is drawn, four cards are left]
(ii) (a) P (an ace) = 14
(b) P (a queen) = $04 = 0$

Question 16.
12 defective pens are accidentally mixed with 132 good ones. It is not possible to just look at a pen and tell whether or not it is defective. One pen is taken out at random from this lot. Determine the probability that the pen taken out is a good one.
Solution:
Number of defective pens = 12
Number of good pens = 132
Total number of pens = 12 + 132 = 144
P (the pen is good one) = $\frac{132}{144} = \frac{11}{12}$

Question 17.
(i) A lot of 20 bulbs contain 4 defective ones. One bulb is drawn at random from the lot. What is the probability that this bulb is defective?
(ii) Suppose the bulb drawn in (i) is not defective and is not replaced. Now one bulb is drawn at random from the rest. What is the probability that this bulb is not defective?
Solution:
(i) Total number of bulbs = 20
Number of defective bulbs = 4
P (bulb drawn is defective) = $\frac{4}{20} = \frac{1}{5}$
(ii) Remaining bulbs = 19
P (bulb drawn is not defective) = $\frac{15}{19}$

Question 18.
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 digit number.
(ii) a perfect square number.
(iii) a number divisible by 5.
Solution:
Total numbers of discs = 90
(i) P (a two digit number) = $\frac{81}{90} = \frac{9}{10}$
(ii) Here, perfect square numbers are 1, 4, 9, 16, 25, 36, 49, 64, 81
P (getting a perfect square number) = $\frac{9}{90} = \frac{1}{10}$
(iii) Numbers divisible by 5 are 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90
P (getting a number divisible by 5) = $\frac{18}{90} = \frac{1}{5}$

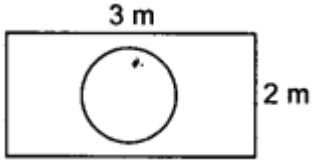
Question 19.
A child has a die whose six faces show the letters as given below:

A	B	C	D	E	A

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

Solution:
(i) P (getting A) = $26 = 13$
(ii) P (getting D) = 16

Question 20.
Suppose you drop a die at random on the rectangular region shown in figure. What is the probability that it will land inside the circle with diameter 1 m?



Solution:

$$\text{Area of rectangle} = 3 \times 2 = 6 \text{ m}^2$$

$$\text{Area of circle} = \pi\left(\frac{1}{2}\right)^2 = \frac{\pi}{4} \text{ m}^2$$

$$\therefore \quad \text{P (the die drops inside the circle)} = \frac{\pi/4}{6} = \frac{\pi}{24}$$

Question 21.
A lot consists of 144 ball pens of which 20 are defective and the others are good. Nuri will buy a pen if it is good, but will not buy if it is defective. The shopkeeper draws one pen at random and gives it to her. What is the probability that
(i) she will buy it?
(ii) she will not buy it?

Solution:
Total number of ball pens = 144
Number of defective pens = 20
Number of good pens = 144 – 20 = 124

$$(i) \qquad \text{P (buy)} = \frac{124}{144} = \frac{31}{36}$$

$$(ii) \qquad \text{P (not buy)} = 1 - \frac{31}{36} = \frac{36 - 31}{36} = \frac{5}{36}$$

Question 22.
Two dice, one blue and one grey, are thrown at the same time. Now

(i) Complete the following table:

Event: (Sum on 2 dice)	2	3	4	5	6	7	8	9	10	11	12
Probability	$\frac{1}{36}$						$\frac{5}{36}$				$\frac{1}{36}$

(ii) A student argues that-there are 11 possible outcomes 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 and 12. Therefore, each of them has a probability 111. Do you agree with this argument? Justify your answer.

Solution:

(i) Total number of possible outcomes = 36

(1, 2) and (2, 1) are the favourable events of getting the sum 3.

P(sum 3) = 236 = 118

(1, 3) , (2, 2) and (3, 1) are the favourable events of getting the sum 4.

P(sum 4) = 336 = 112

(1, 4) , (2, 3), (3, 2) and (4, 1) are the favourable events of getting the sum 5.

P(sum 5) = 436 = 19

(1, 5) , (2, 4), (3, 3), (4, 2) and (5, 1) are the favourable events of getting the sum 6.

P (sum 6) = 536

(1, 6) , (2, 5), (3, 4), (4, 3), (5, 2) and (6, 1) are the favourable events of getting the sum 7.

P(sum 7) = 636 = 16

(3, 6) , (4, 5), (5, 4) and (6, 3) are the favourable events of getting the sum 9.

P(sum 9) = 436 = 19

(4, 6) , (5, 5) and (6, 4) are the favourable events of getting the sum 10.

P(sum 10 = 336 = 112

(5,6) and (6,5) are the favourable events of getting the sum 11.

P(sum 11) = 236 = 118

(ii) No, because the outcomes as 11 different sum are not equally likely.

Question 23.

A game consists of tossing a one rupee coin 3 times and noting its outcome each time. Hanif wins if all the tosses give the same result, i.e. three heads or three tails, and loses otherwise. Calculate the probability that Hanif will lose the game.

Solution:

Possible outcomes are

HHH, TTT, HHT, HTH, THH, TTH, THT, HTT = 8

P (win the game) = 28 = 14

P (lose the game) = 1 – 14 = 34

Question 24.

A die is thrown twice. What is the probability that

(i) 5 will not come up either time?

(ii) 5 will come up at least once?

[Hint: Throwing a die twice and throwing two dice simultaneously are treated as

the same experiment.]

Solution:

Total outcomes = 36

Number of outcomes in favour of 5 is (1, 5) (2, 5) (3, 5) (4, 5) (5, 5) (6, 5) (5, 1) (5, 2) (5, 3) (5, 4) (5, 6) = 11

(i) P (5 will not come up either time) = 2536

(ii) P (5 will come up at least once) = 1136

Question 25.

Which of the following arguments are correct and which are not correct? Give reasons for your answer.

(i) If two coins are tossed simultaneously there are three possible outcomes- two heads, two tails or one of each. Therefore, for each of these outcomes, the probability is 13.

(ii) If a die is thrown, there are two possible outcomes- an odd number or an even number. Therefore, the probability of getting an odd number is 12.

Solution:

(i) Argument is incorrect.

The possible outcomes are (HH), (HT), (TH), (TT)

P(HH) = 14

P(TT) = 14

P(HT or TH) = 24 = 12

(ii) Argument is correct.

Possible outcomes = 1, 2, 3, 4, 5, 6

Odd numbers are = 1, 3, 5

P (an odd number) = 36 = 12

Ex 15.2

Question 1.

Two customers Shyam and Ekta are visiting a particular shop in the same week (Tuesday to Saturday). Each is equally likely to visit the shop on any day as on another day. What is the probability that both will visit the shop on

(i) the same day?

(ii) consecutive days?

(iii) different days?

Solution:

There are a total 5 days (Tuesday to Saturday). Shyam can go to the shop on any of 5 days and Ekta can also go to the shop on 5 days
So total number of outcomes = $5 \times 5 = 25$

(i) They can reach on same day in 5 ways, i.e. (T, T), (W, W), (Th, Th), (F, F), (S, S).

$\therefore$ P (both will reach on same day) $= \frac{5}{25} = \frac{1}{5}$

(ii) They can reach on consecutive day in 8 ways, i.e, (T, W), (W, Th), (Th, F), (F, S) (W, T), (Th, W), (F, Th), (S, F).

$\therefore$ P (both will reach on consecutive days) $= \frac{8}{25}$

(iii) From (i), P (both will reach on same day) $= \frac{1}{5}$

$\therefore$ P (both will reach on different days) $= 1 - \frac{1}{5} = \frac{4}{5}$

Question 2.

A die is numbered in such a way that its faces show the number 1, 2, 2, 3, 3, 6. It is thrown two times and the total score in two throws is noted. Complete the

following table which gives a few values of the total score on the two throws:

Number in second throw	+	Number in first throw					
		1	2	2	3	3	6
	1	2	3	3	4	4	7
	2	3	4	4	5	5	8
	2					5	
	3						
	3			5			9
	6	7	8	8	9	9	12

What is the probability that the total score is
(i) even? (ii) 6? (iii) at least 6?

What is the probability that the total score is at least 6?
(i) even
(ii) 6
(iii) at least 6

Solution:

The given table can be completed as below:

+	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

Total number of possible outcomes when two dice are thrown $= 6 \times 6 = 36$

(i) Total times when the sum is even $= 18$

$$P(\text{getting an even number}) = \frac{18}{36} = \frac{1}{2}$$

(ii) Total times when the sum is $6 = 4$

$$P(\text{getting sum as } 6) = \frac{4}{36} = \frac{1}{9}$$

(iii) Total times when the sum is at least $6 = 15$

$$P(\text{getting sum at least } 6) = \frac{15}{36} = \frac{5}{12}$$

Question 3.

A bag contains 5 red balls and some blue balls. If the probability of drawing a blue ball is doubles that of a red ball, determine the number of blue balls in the bag.

Solution:

Let the number of blue balls be x.
Number of red balls = 5
Total number of balls = $x + 5$

$$P(\text{getting a red ball}) = \frac{5}{x+5}$$

$$P(\text{getting a blue ball}) = \frac{x}{x+5}$$

According to the given information,

$$2\left(\frac{5}{x+5}\right) = \frac{x}{x+5}$$

$$10(x+5) = x^2 + 5x$$

$$x^2 - 5x - 50 = 0$$

$$x^2 - 10x + 5x - 50 = 0$$

$$x(x-10) + 5(x-10) = 0$$

$$(x-10)(x+5) = 0$$

$$x - 10 = 0 \text{ or } x + 5 = 0$$

$$x = 10 \text{ or } x = -5$$

Since, the number of balls can not be negative, the number of blue balls is 10.

Question 4.

A box contains 12 balls out of which x are black. If one ball is drawn at random from the box, what is the probability that it will be a black ball? If 6 more black balls are put in the box, the probability of drawing a black ball is now double of what it was before. Find x.

Solution:

Total number of balls = 12
Total number of black balls = x

$$P(\text{getting a black ball}) = \frac{x}{12}$$

Now, 6 more black balls are put in the box.
Total number of balls = 12 + 6 = 18
Total number of black balls = x + 6

$$P(\text{getting a black ball now}) = \frac{x+6}{18}$$

According to the given information,

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

$$3x = x + 6$$

$$2x = 6$$

$$x = 3$$

Question 5.

A jar contains 24 marbles, some are green and others are blue. If a marble is drawn at random from the jar, the probability that it is green is 2/3. Find the number of blue balls in the jar.

Solution:

Total number of marbles = 24
Let the total number of green marbles be x.
∴ Total number of blue marbles = 24 − x

$$P(\text{getting a green marble}) = \frac{x}{24}$$

According to the given information,

$$\frac{x}{24} = \frac{2}{3}$$

$$x = 16$$

Thus, the total number of green marbles in the jar is 16.
Hence, total number of blue marbles = 24 − 16 = 8