probability

14 Chapter

Exercise 14.1

1. Complete the following statements:

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

Ans: If the probability of an event be p, then the probability of the 'not event' will be, $1-p$. Thus, the sum will be, $p+1-p=1$.

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

Ans: The probability of an event that cannot happen is always 0 .

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

Ans: 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 _____.

Ans: 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 and less than or equal to _____.

Ans: The probability of an event is greater than or equal to 0 and less than or equal to 1 .

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

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

Ans: Equally likely outcomes defined as the outcome when each outcome is likely to occur as the others. So, the outcomes are not equally likely outcome.

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

Ans: The outcomes are not equally likely outcome.

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

Ans: The outcomes are equally likely outcome.

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

Ans: The outcomes are not equally likely outcome.

3. Why is tossing a coin considered to be a fair way of deciding which team should get the ball at the beginning of a football game?

Ans: We already know the fact that a coin has only two sides, head and tail. So, when we toss a coin, it will either give us the result head or tail. There is no chance of the coin landing on his edge. And on the other hand, the chances of getting head and tail are also just the same. So, it can be concluded that the tossing of a coin is a fair way to decide the outcome, as it can not be biased and both teams will have the same chance of winning.

4. Which of the following cannot be the probability of an event?

(A) $\mathbf{\frac{2}{3}}$

Ans: The probability of an event have to always be in the range of $[0,1]$.

Now, let us the check the given values.

We can see, $\frac{2}{3} = 0.67$. This is in the given range. It can be a probability of an event.

(B) -1.5

Ans: We can see, -1.5 , which is a negative number and not inside the given range. It can not be a probability of an event.

(C) 15%

Ans: We can see, $15\% = \frac{15}{100} = 0.15$. This is in the given range of $[0,1]$. It can be a probability of an event.

(D) 0.7

Ans: We can see, 0.7 ,which is in the given range. It can be a probability of an event.

5. If $\mathbf{P(E) = 0.05}$, what is the probability of an event 'not $\mathbf{E}$'?

Ans: The sum of the probabilities of all events in always 1 .

Thus, if $P(E) = 0.05$, the probability of the event 'not E' is, $1 - 0.05 = 0.95$.

6. A bag contains lemon flavored candies only. Malini takes out one candy without looking into the bag. What is the probability that she takes out

(i) an orange flavored candy?

Ans: There is no orange candy available in the bag, so, the probability of taking out an orange flavored candy is 0.

(ii) a lemon flavored candy?

Ans: All the candies in the bag are lemon flavored candies only. Thus, any candy Malini takes out will be a lemon flavored candy.

So, the probability of taking out a lemon flavored candy is 1.

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?

Ans: It is provided to us that, probability of 2 students not having the same birthday is, 0.992.

So,

$$\text{P}(2\,\text{students having the same birthday}) + \text{P}(2\,\text{students not having the same birthday}) = 1$$
$$\Rightarrow \text{P}(2\,\text{students having the same birthday}) + 0.992 = 1$$

Simplifying further,

$$\text{P}(2\,\text{students having the same birthday}) = 0.008$$.

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?

Ans: The bag is having 3 red balls and 5 black balls.

Now, the probability of getting a red ball will be, $\frac{\text{number of red balls}}{\text{total number of balls}}$.

Putting the values, we get, $\frac{3}{3+5}=\frac{3}{8}$.

(ii) not red?

Ans: And, the probability of getting a red ball will be, $1-\frac{\text{number of red balls}}{\text{total number of balls}}$.

Again, putting the values, $1-\frac{3}{8}=\frac{5}{8}$.

9. A box contains 5 red marbles, 8 white marbles and 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?

Ans: The box is containing, 5 red marbles, 8 white marbles and green marbles.

The probability of getting a red marble will be, $\frac{\text{number of red marbles}}{\text{total number of marbles}}$

Putting the values, $\frac{5}{5+8+4}=\frac{5}{17}$.

(ii) white?

Ans: Again, the probability of getting a white marble will be,

$\frac{\text{number of white marbles}}{\text{total number of marbles}}$

Putting the values, $\frac{8}{5+8+4}=\frac{8}{17}$.

(iii) not green?

Ans: And, the probability of getting a green marble will be,

$\frac{\text{number of green marbles}}{\text{total number of marbles}}$.

Putting the values, $\frac{4}{5+8+4}=\frac{4}{17}$.

So, the probability of the marble not being green will be, $1-\frac{4}{17}=\frac{13}{17}$.

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 ?

Ans: We are provided with the fact that, the piggy bank contains, hundred 50 p coins, fifty 1 rs coins, twenty 2 rs coins and ten 5 rs coins.

So, the total number of coins, $100+50+20+10=180$.

Thus, the probability of drawing a 50 p coin, $\frac{100}{180}=\frac{5}{9}$.

(ii) will not be a ₹ 5 coin?

Ans: Similarly, the probability of drawing a 5 rs coin, $\frac{10}{180}=\frac{1}{18}$.

Thus, the probability of not getting a 5 rs coin, $1-\frac{1}{18}=\frac{17}{18}$.

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 Fig. 15.4). What is the probability that the fish taken out is a male fish?

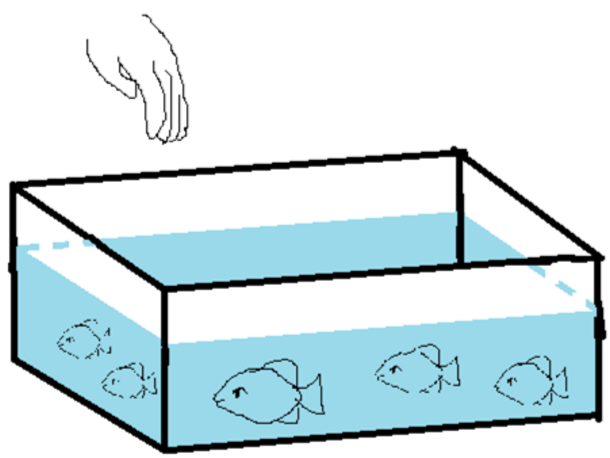

Fig 15.4

Ans: The total number of fishes in the tank, $5+8=13$.

Thus, the probability of getting a male fish, $\frac{\text{no of male fishes}}{\text{total no of fishes}}=\frac{5}{13}$.

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 Fig. 15.5), and these are equally likely outcomes. What is the probability that it will point at

(i) 8?

Ans: We can see, there are 8 numbers on spinner then the total number of favorable outcome is 8 .

Thus, the probability of getting the number 8 is, $\frac{\text{no of digit 8 on the spinner}}{\text{total number of digits}} = \frac{1}{8}$.

(ii) an odd number?

Ans: There are 4 odd digits, $1,3,5,7$.

Thus, the probability of getting an odd number is,

$\frac{\text{no of odd digits}}{\text{total number of digits}} = \frac{4}{8} = \frac{1}{2}$.

(iii) a number greater than 2?

Ans: There are 6 numbers greater than 2, say $3,4,5,6,7,8$.

Thus, the probability of getting a number greater than 2,

$\frac{\text{no of digits greater than 2 on the spinner}}{\text{total number of digits}} = \frac{6}{8} = \frac{3}{4}$.

(iv) a number less than 9?

Ans: As we can see, every number in the spinner is less than 9 , thus, we get,

The probability of getting a number less than 9 , will be, 1 .

13. A die is thrown once. Find the probability of getting

(i) a prime number;

Ans: There is 6 results can be obtained from a dice.

There are 3 prime numbers, $2,3,5$ among those results.

Thus, the probability of getting a prime number,

$$= \frac{\text{no of prime numbers in a dice}}{\text{total numbers on dice}} = \frac{3}{6} = \frac{1}{2}$$

(ii) a number lying between 2 and 6

Ans: There are 3 numbers between 2 and 6, 3,4,5.

Thus, the probability of getting a number between 2 and 6,

$$= \frac{\text{no of numbers between 2 and 6 in a dice}}{\text{total numbers on dice}} = \frac{3}{6} = \frac{1}{2}$$

(iii) an odd number.

Ans: There are 3 odd numbers among the results, 1,3,5.

Thus, the probability of getting a odd number,

$$= \frac{\text{no of odd numbers between in a dice}}{\text{total numbers on dice}} = \frac{3}{6} = \frac{1}{2}$$

14. One card is drawn from a well-shuffled deck of 52 cards. Find the probability of getting

(i) a king of red color

Ans: We know there are 52 numbers in the deck.

There are 2 kings of red color in the deck.

Thus, the probability,

$$= \frac{\text{total number of red kings}}{\text{total number of cards}} = \frac{2}{52} = \frac{1}{26}$$

(ii) a face cards

Ans: There are 12 face cards in the deck.

Thus, the probability,

$$= \frac{\text{total number of face cards}}{\text{total number of cards}} = \frac{12}{52} = \frac{3}{13}$$

(iii) a red face cards

Ans: There are 6 red face cards in the deck.

Thus, the probability,

$$= \frac{\text{total number of red face cards}}{\text{total number of cards}} = \frac{6}{52} = \frac{3}{26}$$

(iv) the jack of hearts

Ans: There are 1 jack of hearts card in the deck.

Thus, the probability,

$$= \frac{\text{total number of red face cards}}{\text{total number of cards}} = \frac{1}{52}$$

(v) a spade

Ans: There are 13 spade cards in the deck.

Thus, the probability,

$$= \frac{\text{total number of spade cards}}{\text{total number of cards}} = \frac{13}{52} = \frac{1}{4}$$

(vi) the queen of diamonds

Ans: There are 1 queen of diamonds card in the deck.

Thus, the probability,

$$= \frac{\text{total number of red face cards}}{\text{total number of cards}} = \frac{1}{52}$$

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?

Ans: There are total 5 cards given in our deck.

Thus, the probability of getting a queen card among the 5 cards,

$$= \frac{\text{number of queen}}{\text{number of total cards}} = \frac{1}{5}$$

(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?

Ans: Now, the queen is put aside, so there will be 4 cards left.

(a) an ace?

Ans: Thus, the probability of getting a queen card among the 5 cards,

$$= \frac{\text{number of ace}}{\text{number of total cards}} = \frac{1}{4}$$

(b) a queen?

Ans: There are no queen cards left in the deck.

Thus, the probability of getting a queen card among the 4 cards,

$$= \frac{\text{number of queen}}{\text{number of total cards}} = \frac{0}{4} = 0$$

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.

Ans: There are total $(132+12)=144$ number of pens in the lot.

And also there are 132 good pens in the given collection.

Thus, the probability of getting a good pen,

$$= \frac{\text{number of good pens}}{\text{number of total pens}} = \frac{132}{144} = \frac{11}{12}$$

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?

Ans: There are 4 defective bulbs among 20 bulbs.

Thus, the probability of getting a defective bulb,

$$= \frac{\text{number of defective bulb}}{\text{number of total bulb}} = \frac{4}{20} = \frac{1}{5}$$

(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 ?

Ans: After the first draw, there are 19 bulbs left in the lot. Again, as the bulb was a non-defective bulb, the total non-defective bulbs are 15.

Therefore, the probability of not getting a defective bulb this time,

$$= \frac{15}{19}.$$

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.

Ans: There are 81 two digit numbers between 1 to 90.

Thus, the probability of getting a two digit number in the draw,

$$= \frac{\text{the total number of two digit numbers}}{\text{total numbers}} = \frac{81}{90} = \frac{9}{10}$$

(ii) a perfect square number

Ans: The number of perfect square numbers between 1 to 90.

Thus, the probability of getting a perfect number in the draw,

$$= \frac{\text{the total number of perfect number}}{\text{total numbers}} = \frac{9}{90} = \frac{1}{10}$$

(iii) a number divisible by 5.

Ans: The number of numbers divisible by 5, 18.

Thus, the probability of getting a number divisible by 5 in the draw,

$$= \frac{\text{the total number of number divisible by 5}}{\text{total numbers}} = \frac{18}{90} = \frac{1}{5}$$

19. A child has a die whose six faces show the letters as given below: A, A, B, C, D, E. The die is thrown once. What is the probability of getting

(i) A?

Ans: There are two A's in the six faces, so, the probability of getting an A,

$$= \frac{\text{total number of A's}}{\text{total number of sides}} = \frac{2}{6} = \frac{1}{3}$$

(ii) D?

Ans: There are one D in the six faces, so, the probability of getting an D,

$$= \frac{\text{total number of D's}}{\text{total number of sides}} = \frac{1}{6}$$

20. Suppose you drop a die at random on the rectangular region shown in Fig. 15.6. What is the probability that it will land inside the circle with diameter 1m?

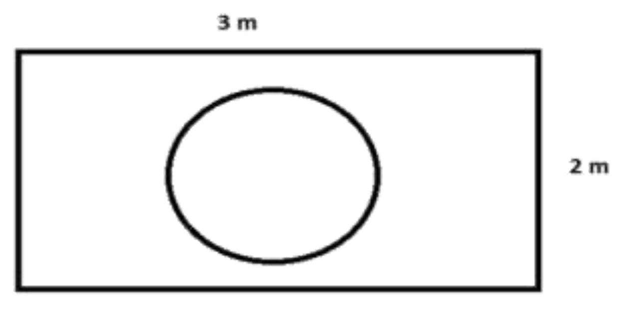

Fig 15.6

Ans: It is given that it is a rectangle with sides 3 m and 2 m.

Thus, the area of the rectangle,

$= \text{length} \times \text{breadth}$

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

The radius of the circle, half of diameter $=\frac{1}{2}\text{m}$.

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

Thus, the probability of the die landing inside the circle is,

$$=\frac{\text{area of the circle}}{\text{area of the rectangle}}=\frac{\frac{\pi}{4}}{6}=\frac{\pi}{24}$$

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 ?

Ans: There are total 144 ball pens in the lot and 20 of them are defective.

Thus, the total number of non-defective pens, $(144-20)=124$.

Nuri will not buy the pen if it is defective, thus,

The probability of getting a good pen is,

$$=\frac{\text{total no of good pens}}{\text{total no of pens}}=\frac{124}{144}=\frac{31}{36}$$

(ii) She will not buy it ?

Ans: Now, the probability of Nuri not buying the pen is,

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

22. Refer to example 13:

(i) Complete the following table:

Event: 'Sum on 2 dices'	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Probability	$\mathbf{\frac{1}{36}}$						$\mathbf{\frac{5}{36}}$				$\mathbf{\frac{1}{36}}$

Ans:

If there are two dices thrown simultaneously, then we can get the following results,

$(1,1),(1,2),(1,3),(1,4),(1,5),(1,6),(2,1),(2,2),(2,3),(2,4),(2,5),(2,6),(3,1),(3,2),(3,3),$
$(3,4),(3,5),(3,6),(4,1),(4,2),(4,3),(4,4),(4,5),(4,6),(5,1),(5,2),(5,3),(5,4),(5,5),$
$(5,6),(6,1),(6,2),(6,3),(6,4),(6,5),(6,6)$

Thus, the total number of results is 36.

Probability of getting a sum of 2, $=\frac{1}{36}$

Probability of getting a sum of 3, $=\frac{2}{36}=\frac{1}{18}$

Probability of getting a sum of 4, $=\frac{3}{36}=\frac{1}{12}$

Probability of getting a sum of 5, $=\frac{4}{36}=\frac{1}{9}$

Probability of getting a sum of 6, $=\frac{5}{36}$

Probability of getting a sum of 7, $=\frac{6}{36}=\frac{1}{6}$

Probability of getting a sum of 8, $=\frac{5}{36}$

Probability of getting a sum of 9, $=\frac{4}{36}=\frac{1}{9}$

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

Probability of getting a sum of 11, $=\frac{2}{36}=\frac{1}{18}$

Probability of getting a sum of 12, $=\frac{1}{36}$

Thus, we get the values of our table.

(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 $\frac{1}{11}$. Do you agree with this argument?

Justify your answer.

Ans: As we can see different values all over the table, we can conclude that, the given statement is wrong. The probability of each of them can never be $\frac{1}{11}$.

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.

Ans: Hanif will win if he gets 3 heads and 3 tails consecutively.

The probability of Hanif losing the game, = The probability of not getting 3 heads and 3 tails.

The possible outcomes of the tosses,

$(HHH, HHT, HTH, HTT, THH, THT, TTH, TTT)$

The total number of outcomes is, 8.

Thus, the probability of not getting 3 heads and 3 tails,

$$=1-\frac{2}{8}=\frac{6}{8}=\frac{3}{4}.$$

24. A die is thrown twice. What is the probability that

(i) 5 will not come up either time?

[Hint: Throwing a die twice and throwing two dice simultaneously are treated as the same experiment]

Ans: We can see that two dices are thrown altogether, thus the total number of outcomes =36.

Now, the total cases where atleast 5 occurs is, 11, i.e,

$(1,5),(2,5),(3,5),(4,5),(5,5),(6,5),(5,1),(5,2),(5,3),(5,4),(5,6)$

So, the probability of not getting 5 either time is, $=1-\frac{11}{36}=\frac{25}{36}$.

(ii) 5 will come up at least once?

Ans: And, probability of getting 5 atleast once is, $\frac{11}{36}$.

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 $\frac{1}{3}$.

Ans: In this problem, two coins are tossed simultaneously, thus we get 4 outcomes, i.e, (HH, HT, TH, TT) .

So, the probability of getting both heads and tails, $= \frac{2}{4} = \frac{1}{2}$.

Thus, the statement is wrong.

(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 $\frac{1}{2}$.

Ans: By throwing a die, we get 6 possible outcomes.

The odd numbers are $1, 3, 5$.

Thus the probability of getting a odd number, $= \frac{3}{6} = \frac{1}{2}$.

So, the statement is true.