Probability

Class X

Exercise: 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 1:

i) 1
ii) 0
iii) 1
iv) 1
v) 0,1

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 2:

Equally likely outcomes- When each outcome is likely to occur as the others

i) Not equally likely outcome
ii) Not equally likely outcome
iii) Equally likely outcome

iv) Equally likely outcome

Question 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?

Solution 3:

We are aware that a coin has only two sides- head and tail. So if we toss a coin it will definitely land either on head or on tail as there is no chance of the coin landing on its edge. Moreover, the chance of getting head and the chance of getting tail is the same. Thus, tossing a coin is a fair way of decision making because both the outcomes (head and tail) are **equally likely** which means that the result can never be biased and both teams have an equal chance of winning.

Question 4:

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

(A)23
(B) –1.5
(C) 15%
(D) 0.7

Solution 4:

The probability of an event occurring is always between 0 to 1. This means the probability of an event can never be less than zero or more than 1.

0<P<1

i) ⅔ = 0.67 -This can be the probability of an event because it's more than zero and less than 1
ii) -1.5 - This can be the probability of an event because it's negative (i.e, less than zero)
iii) 15% = 15/100 = 0.15 - This can be the probability of an event because it's more than zero and less than 1
iv) 0.7 - This can be the probability of an event because it's more than zero and less than 1

Question 5:

If P(E) = 0.05, what is the probability of 'not E'?

Solution 5:

We know that the sum of probability of all possible events is one.
Thus the sum of P(E) and P(Not E)= 1
P(E)+ P(Not E) = 1
0.05 + P(Not E)= 1 ------ substituting the value of P(E) = 0.05
P(Not E) = 1 - 0.05
P(Not E) = 0.95

Therefore, the probability of P(Not E) is 0.95.

Question 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?
(ii) a lemon flavored candy?

Solution 6:

i) The probability of getting orange flavoured candy is zero because there is no orange candy in the bag. Thus it is not possible to take out an orange flavoured candy from a bag of lemon flavoured candy,
P(an orange flavoured candy)= 0

ii) The probability of getting a lemon flavoured candy is one because there is only one possible outcome. So it's a sure event.

P (a lemon flavoured candy)+ P(not a lemon flavoured candy) = 1.
P (a lemon flavoured candy) + 0 = 1
P (a lemon flavoured candy) = 1 - 0
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 7:

Probability of 2 students not having the same birthday is 0.992
Therefore,

P(2 students having the same birthday) + P(2 students having the same birthday) = 1
P(2 students having the same birthday) + 0.992 = 1
P(2 students having the same birthday)= 1- 0.992
P(2 students having the same birthday) = 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 8:

If a bag contains 3 red and 5 black balls then,

The probability of getting a red ball = Number of red balls/ total number of balls in the bag.
= 3/ (3+5)

= 3/8

The probability of not getting a red ball = 1 - the probability of getting a red ball
= 1- 3/8
= ⅝

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 9:

i) The probability of getting a red marble = no of red marbles / total number of marbles
= 5 / (5+8+4)
= 5/ 17

ii) The probability of getting a white marble = no of white marbles / total number of marbles
= 8 / (5+8+4)
= 8/17

iii) The probability of getting a green marble = no of green marbles / total number of marbles
= 4 / (5+8+4)
= 4/17

P(a green marble) + P(not a green marble) = 1
P(not a green marble) = 1- P(a green marble)
= 1- 4/17
= 13/17

Thus the probability of not getting a green marble is 13/ 17.

Question 10:

A piggy bank contains hundred 50p 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 10: Solution missing

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

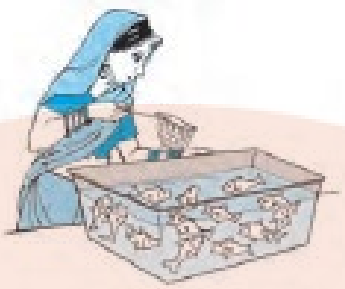

Fig. 15.4

Solution 11:

The probability of getting a male fish = Number of male fishes/ Total number of fishes
= Number of male fishes/ Number of male and female fishes
= 5/ (5+8)
= 5/ 13.

Thus, the probability of getting a male fish is 5/13.

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 Fig. 15.5), 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 12:

If there are 8 numbers on spinner then the total number of favorable outcome is 8

i) The probability of getting the number 8 = Number of digit 8 on spinner / total number of digits
= 1 / 8
ii) The probability of getting an odd number = Number of odd digits/ total number of digits
= 4/ 8
iii) The probability of getting a number greater than 2
=Number of digits greater than on 2 spinner/ total number of digits
= 6/ 8
= 3/ 4
iv) The probability of getting a number less than 9
=Number of digits less than 9 on spinner/ total number of digits
= 8/8
= 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; (iii) an odd number.

Solution 13:

Dice is a cube with 8 surfaces, each having a number on it (i.e-1,2,3,4,5.6). Thus, the number of equally likely outcome is 6.

i) The probability of getting a prime number
= No of prime numbers (i.e. 2, 3 and 5) on dice/ Total numbers on dice
= 3/ 6
= ½

ii) The probability of getting a number between 2 and 6
= No of numbers between 2 and 6 on dice/ Total numbers on dice
= 3/ 6
= ½

iii) The probability of getting an odd number
= No of odd numbers (i.e. 1, 3 and 5) on dice/Total numbers on dice
= 3/ 6
= ½

Question 14:

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

(i) a king of red color
(ii) a face cards
(iii) a red face cards
(iv) the jack of hearts
(v) a spade
(vi) the queen of diamonds

Solution 14:

The total number of cards in a deck: 52

(i) The probability of getting a king of red color
= Total cards of red color kings/ Total number of cards
= 2/ 52
= 1/26

(ii) The probability of getting a face card
= Total face cards/ Total number of cards
= 12/ 52
= 3/13

(iii) The probability of getting a red face
= Total red face cards/ Total number of cards
= 6/ 52
= 3/26

(iv) The probability of getting a jack of hearts
= Total jack of hearts/ Total number of cards
= 1/52
v) The probability of getting a spade
= Total spade cards/ Total number of cards
= 13/ 52
= ¼

(vi) The probability of getting a queen of diamonds
= Total queen of diamond cards/ Total number of cards
= 1/52

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 15:

i) The probability of getting a queen card from 5 cards
= Number of queen cards/ Total cards
= 1/ 5

ii) If the queen card is put aside from 5 cards, then, there will be 4 cards left.

(a) The probability of getting an ace out of 4 cards
= Number of ace cards/ Total cards left
= ¼

(b) The probability of getting a queen out of 4 cards
= Number of queen cards left after keeping aside the first card/ Total cards left
= 0/4
= 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 16:

Probability of getting a good pen = Number of good pens/ Total number of pens
= Number of good pens/ Number of good and defective pens
= 132/ (12+132)
= 132/ 144
= 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 17:

The probability of getting a defective bulb = Number of defective bulbs/ Total number of bulbs
= 4/ 20
= ⅕
Since the number of defective bulbs was 4 out of 20.
Then, the number of non-defective bulbs was (20-4) that is 16
Now if bulb drawn previously was non-defective and was not even replaced.
Then, the number of non-defective bulbs left = 16-1 = 15

Therefore, the probability of not getting a defective bulb this time
= the number of non-defective bulbs left/ the number of total bulbs left
= 15/ (20-1)
= 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 18:

i)The probability of getting a two-digit number from out of 90 discs numbered from 1 to 90
= Total number of two-digit numbers between 1 to 90/ Total numbers
= 81/ 90
= 9/10

ii)The probability of getting a perfect square number
= Total number of perfect squares till 90 / Total numbers
= 9/ 90

iii) The probability of getting a number divisible by 5
= Total number of divisible by 5 till 90 / Total numbers
= 18/ 90

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 19:

i) The probability of getting A on a die of 6 surfaces having alphabets A, A, B, C, D, E is 2/6 as there are 2 surfaces having A on it out of 6 surfaces.

ii) The probability of getting D on a die of 6 is 1/6 as there is 1 surface with D out of 6 surfaces.

Question 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?

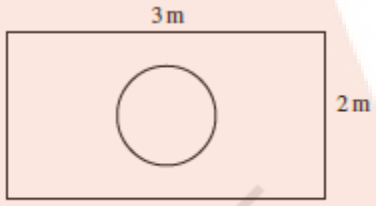

Fig. 15.6

Solution 20:

The given figure is a rectangle of length 3cm and breadth 2cm.
The area of Rectangle = length*breadth
= 3*2
= 6 cm square
The radius of the circle inside the rectangle = half of diameter
= ½ m
The area of a circle= pie*r2
= pie / (½)2
= pie / 4
Now if a die is thrown on the rectangular region then the probability of the die falling inside the circle is:

Area of the circle/ area of the rectangle
= (pie / 4) / 6 cm square

= pie / 24 cm square.

Thus, the probability of the die falling inside the circular region is pie / 24 cm square.

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 21:

If a lot of 144 pens has 20 defective pens then the total number of non-defective pens should be (144-20) that is 124 pens.

If the pen drawn by shopkeeper is defective then Nuri will not buy it but if it's not defective then she will buy it.
So, the probability of getting a good pen is 124/ 144 which is equal to 31/36.

Thus, the probability of Nuri buying the pen is 31/36.
And the probability of Nuri not buying the pen is (1-31/36) = 5/ 36.

Question 22:

Refer to Example 13. (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 1/11. Do you agree with this argument? Justify your answer.

Solution 22:

If two dice are thrown at the same time then the possible outcomes are:

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

i) Number of total outcomes = 36

Probability of getting a sum of 2= 1/36
Probability of getting a sum of 3= 2/36

Probability of getting a sum of 4= 3/36
Probability of getting a sum of 5= 4/36
Probability of getting a sum of 6= 5/36
Probability of getting a sum of 7= 6/36
Probability of getting a sum of 8= 5/36
Probability of getting a sum of 9= 4/36
Probability of getting a sum of 10= 3/36
Probability of getting a sum of 11= 2/36
Probability of getting a sum of 12= 1/36

ii) No, I do not agree with the statement as the probability of each of them can never be 1/11 as the sums 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 23:

The probability of Hanif losing the game = The probability of not getting 3 heads and 3 tails in all the tosses.

Now, the possible outcomes- (HHH, TTT, TTH, HHT, THT, HTH, THH, HTT)

The probability of not getting 3 heads and 3 tails = 6/8 = ¾.

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 24:

If a die having 6 surfaces is thrown twice then the possible outcomes = 6*6= 36

i) Probability of not getting 5 either time + Probability of getting 5 either time = 1
Probability of not getting 5 either time + (11/36) = 1
Probability of not getting 5 either time = 1 - (11/36)
Probability of not getting 5 either time = 25/36

ii) Probability of getting 5 either time = No of outcomes of getting 5 either time/ Total outcomes
= 11 / 36

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 ⅓.
(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 1/2.

Solution 25:

(i) As we know if two coins are tossed simultaneously then there are 4 possible outcomes. (i.e. HH, TT, HT, TH)

The chance of getting Head and Tail is 2 (i.e. HT, TH).
So, the probability of getting Head and Tail is 2/ 4 or ½.

Therefore, the given statement is wrong.

ii) The given statement is correct because when a die is thrown there are equal chances of getting odd numbers (1,3,5) and even numbers (2,4,6)

Thus, the probability of getting an odd number is 3/6 which is equal to ½.

Exercise: 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 1:

If Shyam and Ekta are visiting a particular shop on the same week which starts from Tuesday and ends on Saturday then the total days in the week is 5.

Now, if each of them visiting the shop is equally likely then,

The outcome of the event of Shyam visiting the shop is 5
The outcome of the event of Ekta visiting the shop is 5
The total number of ways (combination):
(TT), (TW), (TTh),(TF), (TS), (WT), (WW), (WTh), (WF), (WS), (ThT), (ThW), (ThTh), (ThF), (ThS), (FT), (FW), (FTh), (FF), (FS), (ST), (SW), (STh), (SF), (SS).

Thus, Total outcome events = 5*5 = 25

i) The probability of both of them reaching the shop on the same day
= the number of ways they can reach the shop on the same day / the total number of ways.
= (T,T) , (W,W) , (Th, Th), (F,F), (S,S) / 25
= 5/ 25
= ⅕

ii) The probability of both of them reaching on consecutive days
= the number of ways they can reach the shop on consecutive days / the total number of ways
= (TW), (WTh), (Th F), (FS), (WT),(ThW), (FTh), (SF) / the total number of ways
= 8/25

iii) P(both of them reaching on same days) + P(both of them reaching not on same days)= 1
⅕ + P(both of them reaching not on same days) = 1
P(both of them reaching not on same days) = 1- (⅕)
P(both of them reaching not on same days) = ⅘

Therefore, the probability of both of them not reaching on the same day (different day) = ⅘

Question 2:

A die is numbered in such a way that its faces show the numbers 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:

Solution 2:

i) The probability of getting the total score as even
= The ways of getting even sum / Total ways
= 18 / 36 ------- from the table

ii) The probability of the total as 6
= The ways of getting a sum of 6 / Total ways
= 4/ 36 ------- from the table

iii) The probability of the total sum as 6 or less than 6
= The ways of getting the total sum as 6 or less than 6/ Total ways
= 15 / 36 ------- from the table

Question 3:

A bag contains 5 red balls and some blue balls. If the probability of drawing a blue ball

is *double* that of a red ball, determine the number of blue balls in the bag.

Solution 3:

A bag of 5 red balls and x blue balls will be having total 5+x balls.
If the probability of getting a blue ball is double the probability of getting a red ball then

2(probability of getting a blue ball) = probability of getting a red ball
2(Number of blue balls/ total balls) = Number of red balls / total balls
2(x/ 5+x)/ 5+x = (5/ 5+x)/ 5+x
X = 10 or -5
Number of blue balls cannot be negative thus x = 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 4:

i) If a box of 12 balls has x black balls and 12-x other balls then

The probability of getting a black ball = no of black balls/total balls
= x / 12

ii) If 6 more balls are added then the total number of black balls = x+6
And the total number of balls = 12 + 6 = 18

So, the probability of getting a black ball = no of black balls/ total balls
= x+ 6 / 18
Now, if the probability of getting a black ball is double of before then
2 (probability of getting a black ball before) = probability of getting a black ball now
2 (x / 12) = x+ 6 / 18
X = 3

Thus, the number of black balls before was 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 5:

If the total number of marbles is 24 and the total number of green marbles is x then
The total number of blue marbles = 24 - x

The probability of getting a green marble = number of green marble/ total number of marbles
= x/ 24

Given, the probability of getting a green marble = ⅔

Then,

x/ 24= ⅔

x= 16

Therefore, if the number of green marbles is 16 then

the number of blue marbles is 24-16 = 8.