CHAPTER 15 – PROBABILITY

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 _____.

Answer: (i) 1
(ii) 0 ; impossible event
(iii) 1 ; sure event
(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 Solution: a true-false question. The Solution is right or wrong.
(iv). A baby is born. It is a boy or a girl.

Answer: (i) The statement does not have equally likely outcomes as the ignition of the car depends upon various factors like engine, fuel, etc.

(ii) This statement also does not have equally likely outcomes as the player may shoot the target or miss the shot.

(iii) It has equally likely outcome as both have equal chances to happen.

(iv). It has also equally likely outcome as the newly born baby can either be a boy or a girl.

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

Answer: When we toss a coin, the outcome may be Head or Tail, which is equally likely. So, the 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

Answer: As we know that, the probability of any event (E) always lies between 0 and 1
i.e. 0 ≤ P(E) ≤ 1. So, from the given options, option (B) -1.5 cannot be the probability of an event. A probability will not be negative or greater than 1 in any case.

Question 5: If P(E) = 0.05, what is the probability of 'not E'?

Answer: We know that,
P(E)+P(not E) = 1

And it is given that, P(E) = 0.05
Hence, P(not E) = 1-P(E)
or, P(not E) = 1 - 0.05

Therefore, P(not E) = 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?

Answer: (i) As it is given that the bag only contains lemon-flavoured candies, there will be no orange flavoured candies.

Hence, the probability of taking out orange flavoured candies = $\frac{0}{1}$ = 0

(ii) As we know that, there are only lemon flavoured candies,
Hence, P(lemon flavoured candies) = 1 (or 100%)

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?

Answer: Let the event where two students have the same birthday be E.
So, P(E) = 0.992

Now, P(E)+P(not E) = 1
or, P(not E) = 1 – 0.992 = 0.008

Hence, probability that the 2 students have the same birthday is 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 is drawn is
(i) red?
(ii) not red?

Answer: Number of red balls = 3
Number of black balls = 5
So, the total number of balls = 8

(i) P(red ball) = $\frac{number\ of\ red\ balls}{total\ number\ of\ balls} = \frac{3}{8}$
(ii) 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?

Answer: Number of red marbles = 5
Number of white marbles = 8
Number of green marbles = 4
So, total number of marbles = 5 + 8 + 4 = 17

(i) P(red marble) = $\frac{5}{17}$

(ii) P(white marble) = $\frac{8}{17}$

(iii) P(not green) = 1 – P(green) = 1 - $\frac{4}{17} = \frac{13}{17}$

Question 10: A piggy bank contains hundred 50p coins, fifty Rs.1 coins, twenty Rs.2 coins and ten Rs.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 an Rs. 5 coin?

Answer: Number of 50p coins = 100
Number of Rs. 1 coins = 50
Number of Rs. 2 coins = 20
Number of Rs. 5 coins = 10
Total number of coins = 180

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

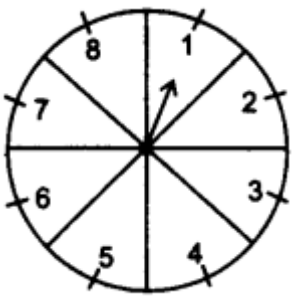
(ii) P(not a Rs. 5 coin) = 1 - $\frac{10}{180} = \frac{170}{180} = \frac{17}{18}$

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

Answer: Given the total number of fish in the tank = 5+8 = 13
Total number of male fish = 5

P(E) = $\frac{number\ of\ favourable\ outcomes}{total\ number\ of\ outcomes}$
or, P (male fish) = $\frac{5}{13}$ = 0.38

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?



Answer: (i) P(getting 8) = $\frac{1}{8}$

(ii) P(an odd number) = $\frac{4}{8} = \frac{1}{2}$ (odd numbers are 1, 3, 5, 7)

(iii) P(a number greater than 2) = $\frac{3}{8} = \frac{3}{4}$

(iv) P(a number less than 9) = $\frac{8}{8}$ = 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.

Answer: Total number of outcomes (1, 2, 3, 4, 5, 6) = 6

(i) Number of favourable outcomes (2, 3, 5 are prime numbers) = 3
P(getting a prime) = $\frac{3}{6} = \frac{1}{2}$

(ii)Number of favourable outcomes (3, 4, 5) = 3
P(getting a number between 2 and 6) = $\frac{3}{6} = \frac{1}{2}$

(iii)Number of favourable outcomes (1, 3, 5 are odd) = 3
P(getting an odd number) = $\frac{3}{6} = \frac{1}{2}$

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

Answer: Number of cards in a deck = 52

(i) P(king of red colour) = $\frac{2}{52} = \frac{1}{26}$

(ii) P(a face card) = $\frac{12}{52} = \frac{3}{13}$

(iii) P(red face card) = $\frac{6}{52} = \frac{3}{26}$

(iv) P(the jack of hearts) = $\frac{1}{52}$

(v) P(a spade) = $\frac{13}{52} = \frac{1}{4}$

(vi) P(the queen of diamonds) = $\frac{1}{52}$

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?

Answer: Total numbers of given cards = 5

P(E) = $\frac{number\ of\ favourable\ outcomes}{total\ number\ of\ outcomes}$

(i) Numbers of queen = 1
P(picking a queen) = $\frac{1}{5}$ = 0.2

(ii) If the queen is drawn and put aside, the total numbers of cards left is (5 - 1) = 4

(a) Total numbers of ace = 1
P(picking an ace) = $\frac{1}{4}$ = 0.25

(b) Total numbers of queen = 0
P(picking a queen) = = $\frac{0}{4}$ = 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 is taken out is a good one.

Answer: Number of defective pens = 12
Number of good pens = 132
Total number of pens = 12 + 132 = 144

P(of getting a good pen) = $\frac{132}{144} = \frac{11}{12}$

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 is 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?

Answer: (i) Total number of outcomes = total number of bulbs = 20
Number of favourable outcomes = Number of defective bulbs = 4
P(E) = $\frac{number\ of\ favourable\ outcomes}{total\ number\ of\ outcomes}$

or, P(getting a defective bulb) = $\frac{4}{20} = \frac{1}{5}$

(ii) After keeping a good bulb aside, the total number of outcomes = 19
Number of favourable outcomes = number of good bulbs = 15

P(getting a good bulb) = $\frac{15}{19}$

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.

Answer: The total numbers of discs = 50

P(E) = $\frac{number\ of\ favourable\ outcomes}{total\ number\ of\ outcomes}$

(i) Total number of discs having two digit numbers (total 2 digit numbers are 90-9 = 81) = 8
P (bearing a two-digit number) = $\frac{81}{90} = \frac{9}{10}$ = 0.9

(ii) Total number of perfect square numbers (1, 4, 9, 16, 25, 36, 49, 64 and 81) = 9
P (getting a perfect square number) = $\frac{9}{90} = \frac{1}{10}$ = 0.1

(iii) Total numbers which are divisible by 5 (5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85 and 90) = 18
P (getting a number divisible by 5) = $\frac{18}{90}$ = ⅕ = 0.2

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

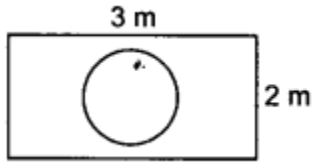
The die is thrown once. What is the probability of getting
(i) A?
(ii) D?

Answer: Total number of outcomes = 6

(i) number of favourable outcomes = 2
P(getting A) = $\frac{2}{6} = \frac{1}{3}$

(ii) number of favourable outcomes = 1
P(getting D) = $\frac{1}{6}$

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



Answer: Area of rectangle = (3 × 2) m^2 = 6 m^2

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

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

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 cell at random and gives it to her. What is the probability that
(i). Will she buy it?
(ii) She will not buy it?

Answer: Total number of bullpens = 144
Number of defective ballpens = 20
Then, the number of good pens = 144 – 20 = 124

(i) P(getting a good pen) = $\frac{124}{144} = \frac{31}{36}$

(ii) P(getting a defective pen) = 1 – P(getting a good pen) = 1 - $\frac{31}{36}$

$= \frac{5}{36}$

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 likelihood. Do you agree with this argument? Justify your answer.

Answer: If 2 dices are thrown, the possible events 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)

So, the total numbers of events = 36

(i) P(sum of 3) = $\frac{2}{36} = \frac{1}{18}$

P(sum of 4) = $\frac{3}{36} = \frac{1}{12}$

P(sum of 5) = $\frac{4}{36} = \frac{1}{9}$

P(sum of 6) = $\frac{5}{36}$

P(sum of 7) = $\frac{6}{36} = \frac{1}{6}$

P(sum of 9) = $\frac{4}{36} = \frac{1}{9}$

P(sum of 10) = $\frac{3}{36} = \frac{1}{12}$

P(sum of 11) = $\frac{2}{36} = \frac{1}{18}$

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.

Answer: The total number of outcomes (HHH, HHT, HTH, THH, TTH, HTT, THT, TTT) = 8
Total outcomes in which Hanif will lose the game (HHT, HTH, THH, TTH, HTT, THT) = 6

P(losing the game) = $\frac{6}{8} = \frac{3}{4}$ = 0.75

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]

Answer: The 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)

So, the total number of outcomes = 36

(i) P(5 will not come up either time) = $\frac{25}{36}$

(ii) P(5 will come up at least once) = $\frac{11}{36}$

Question 25: Which of the following arguments are correct, and which are not accurate? Give reasons for your Solution

(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 $\frac{1}{3}$
(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 $\frac{1}{2}$

Answer: (i) Total possible outcomes (HH, HT, TH, TT) = 4
P(getting two heads) = $\frac{1}{4}$

P(getting two tails) = $\frac{1}{4}$

P(getting one head one tail) = $\frac{2}{4} = \frac{1}{2}$
Hence, the given argument is false.

(ii) Total possible outcomes are (1, 2, 3, 4, 5, 6) = 6
P(getting an odd number) = $\frac{3}{6} = \frac{1}{2}$

P(getting an even number) = $\frac{3}{6} = \frac{1}{2}$
Hence, the given argument is true.

Exercise 15.2

Question 1: Two customers Shyam and Ekta visit 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?

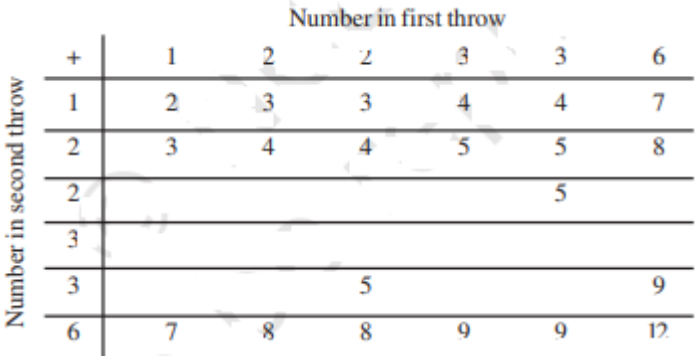
Answer: There are 5 days and both can go to the shop in 5 ways each so,
So, the total number of possible outcomes = 5×5 = 25

(i) The number of favourable events (Tue., Tue.), (Wed., Wed.), (Thu., Thu.), (Fri., Fri.), (Sat., Sat.) = 5
P(both visiting on the same day) = $\frac{5}{25} = \frac{1}{5}$

(ii) The number of favourable events (Tue., Wed.), (Wed., Thu.), (Thu., Fri.), (Fri., Sat.), (Sat., Fri.), (Fri., Thu.), (Thu., Wed.), and (Wed., Tue.) = 8
P(both visiting on the consecutive days) = $\frac{8}{25}$

(iii) P(both visiting on the different days) = 1 - P (both visiting on the same day)
P(both visiting on the different days) = 1 - $\frac{1}{5} = \frac{4}{5}$

Question 2: A die is numbered so 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:



	Number in first throw					
Number in second 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?

Answer:

+	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

The total number of outcomes = 36

(i) E (Even) = 18
P (Even) = $\frac{18}{36} = \frac{1}{2}$

(ii) E (sum is 6) = 4
P (sum is 6) = $\frac{4}{36} = \frac{1}{9}$

(iii) E (sum is at least 6) = 15
P(sum is at least 6) = $\frac{15}{36} = \frac{5}{2}$

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.

Answer: Total number of red balls = 5
Let the total number of blue balls = x

Therefore, the total no. of balls = (x+5)

P(E) = $\frac{number\ of\ favourable\ outcomes}{total\ number\ of\ outcomes}$

P(drawing a blue ball) = $\frac{x}{x+5}$……..(1)

Similarly,
P(drawing a red ball) = $\frac{5}{x+5}$……(2)

Hence, from equation (1) and (2), the total number of blue balls = 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.

Answer: Total number of black balls = x [Given]
Total number of balls = 12 [Given]

P(E) = $\frac{number\ of\ favourable\ outcomes}{total\ number\ of\ outcomes}$

P(getting black balls) = $\frac{x}{12}$
……(1)
Now, 6 more black balls are added,
So, total balls become = 18
Total number of black balls = x+6
Now, P (getting black balls) =
$\frac{x+6}{18}$……(2)

The probability of drawing a black ball now is double of what it was before, [Given]

Eq. (2) = 2 × Eq. (1)
So, $\frac{x+6}{18} = 2 \times \frac{x}{12}$
or, x + 6 = 3x
or, 2x = 6
Hence, 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 ⅔. Find the number of blue balls in the jar.

Answer: Total number of marbles = 24
Let the total number of green marbles = x
So, the total blue marbles = 24 - x

Therefore, P(getting green marble) = $\frac{x}{24}$

So, from the question, $\frac{x}{24} = \frac{2}{3}$

So, the total number of green marbles = 16
And, the total number of blue marbles = 24 - x = 8.