NCERT QUESTIONS WITH SOLUTIONS

EXERCISE : 14.1

1. Complete the following statements :

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

(ii) 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 ____.

Sol. (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. 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.

Sol. (i) The car will start if all its part working perfectly but if there is some defect in its parts, it will not start. So it is not equally likely.

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

$\therefore$ The outcome are not equally likely.

(iii) The outcome in this trial of true-false question is either true or false, i.e., one out of the two and both have equal chances to happen. Hence, the two outcomes are equally likely.

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

$\therefore$ The outcomes either a boy or a girl are equally likely to occur.

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?

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

(A) $\frac{2}{3}$ (B) –1.5

(C) 15% (D) 0.7

Sol. Probability of an event cannot be less than 0 and greater than 1. Therefore, the correct option is (B) because be –1.5 is less than 0.

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

Sol. We have P(E) = 0.05

$\therefore$ P(not E) = 1 – P(E) = 1 – 0.05 = 0.95

Therefore, P(not E) = 0.95.

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?

Sol. (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.

This is impossible event.

(ii) Also probability of taking out a this is sure (certain) event. lemon flavoured candy = 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?

Sol. Event E is that two students out of 3 have same birthday. We are given that P (not E) = 0.992.

Then P(E) =1 – P(not E) = 1–0.992 = 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 (ii) not red?

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

$\therefore$ Number of possible outcomes = 8

(i) There are 3 red balls.

$\therefore$ Number of favourable outcomes = 3

$\therefore$ P(red)

$= \frac{\text{Number of favourable outcomes}}{\text{Number of all possible outcomes}} = \frac{3}{8}$

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

$= 1 - P(\text{red}) = 1 - \frac{3}{8} = \frac{8-3}{8} = \frac{5}{8}$

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?

Sol. Total number of marbles in the box

= 5 + 8 + 4 = 17.

Let A_1 = Event of getting a red marble,

A_2 = Event of getting a white marble

and A_3 = Event of getting a green marble.

(i) There are 5 red marbles in the box.

Hence, required probability

$= P(A_1)$ = P(getting a red marble)

$= \frac{5}{17}$

(ii) There are 8 white marbles in the box.

Hence, required probability = $P(A_2)$

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

(iii) There are 4 green marbles in the box.

$\therefore$ $P(A_3)$ = P(getting a green marble)

= $\frac{4}{17}$

Hence, required probability

= P(not getting a green marble)

= 1 – P(getting a green marble)

= $1 - P(A_3) = 1 - \frac{4}{17} = \frac{13}{17}$.

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 50p coin

(ii) will not be a Rs 5 coin?

Sol. Number of : 50 p coins = 100,

₹ 1 coins = 50

₹ 2 coins = 20, ₹ 5 coins = 10

Total number of coins

= 100 + 50 + 20 + 10 = 180

$\therefore$ Total possible outcomes = 180

(i) For a 50 p coin :

Favourable events = 100

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

(ii) For not a ₹ 5 coin :

$\because$ Number of ₹ 5 coins = 10

$\therefore$ Number of 'not ₹ 5' coins

= 180 – 10 = 170

Favourable outcomes = 170

$\therefore$ $P(\text{not 5 rupee coin}) = \frac{170}{180} = \frac{17}{18}$

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

Sol. Number of male fishes = 5

Number of female fishes = 8

$\therefore$ Total number of fishes = 8 + 5 = 13

Total number of outcomes = 13

For a male fish :

Number of favourable outcomes = 5

$\therefore$ $P(\text{male fish}) = \frac{5}{13}$.

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, 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?

Sol. Total number marked = 8

$\therefore$ Total number of possible outcomes = 8

(i) When pointer points at 8

Number of favourable outcomes = 1

$\therefore$ P(8) = $\frac{\text{No. of favourable outcomes}}{\text{Total number of possible outcomes}} = \frac{1}{8}$

(ii) When pointer points at an odd number :

$\because$ Odd numbers are 1, 3, 5 and 7

$\therefore$ Number of favourable outcomes = 4

$\therefore$ P(odd)

$= \frac{\text{No. of favourable outcomes}}{\text{Total number of possible outcomes}} = \frac{4}{8} = \frac{1}{2}$

(iii) When pointer points at a number greater than 2 ($\because$ The numbers 3, 4, 5, 6, 7 and 8 are greater than 2)

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

Number of favourable outcomes = 6

$\therefore$ P(greater than 2)

$= \frac{\text{No. of favourable outcomes}}{\text{Total number of possible outcomes}} = \frac{6}{8} = \frac{3}{4}$

(iv) When pointer points a number less than 9

$\because$ The numbers 1, 2, 3, 4, 5, 6, 7 and 8 are less than 9.

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

Number of favourable outcomes = 8

P(less than 9)

$= \frac{\text{No. of favourable outcomes}}{\text{Total number of possible outcomes}} = \frac{8}{8} = 1$

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

(i) a prime number

(ii) number lying between 2 and 6

(iii) an odd number.

Sol. There are 6 outcomes when a die is thrown. These are 1, 2, 3, 4, 5, 6 and all have equally likely chances.

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

Therefore P(getting a prime)

$= \frac{3}{6} = \frac{1}{2}$

(ii) 3, 4, 5 are the numbers lying between 2 and 6. Therefore, P (getting a number between 2 and 6)

$= \frac{3}{6} = \frac{1}{2}$

(iii) 1, 3, 5 are the odd numbers.

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

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

(i) a king of red colour

(ii) a face card

(iii) a red face card

(iv) the jack of hearts

(v) a spade

(vi) the queen of diamonds

Sol. Number of cards in deck = 52

$\therefore$ Total number of possible outcomes = 52

(i) Number of red colour kings = 2

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

Number of favourable outcomes = 2

P(red king)

$= \frac{\text{No. of favourable outcomes}}{\text{Total number of possible outcomes}} = \frac{2}{52} = \frac{1}{26}$

(ii) For a face card

$\because$ 4 kings, 4 queens and 4 jacks are face cards

$\therefore$ Number of face cards = 12

Number of favourable outcomes = 12

$\therefore$ P(face card)

$$= \frac{\text{No. of favourable outcomes}}{\text{Total number of possible outcomes}}$$

$$= \frac{12}{52} = \frac{3}{13}$$

(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.

Favourable outcomes = 6

$\therefore$ P(red face card)

$$= \frac{\text{No. of favourable outcomes}}{\text{Total number of possible outcomes}}$$

$$= \frac{6}{52} = \frac{3}{26}$$

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

$\therefore$ Number of favourable outcomes = 1

$\therefore$ P(jack of hearts)

$$= \frac{\text{No. of favourable outcomes}}{\text{Total number of possible outcomes}} = \frac{1}{52}$$

(v) There are 13 spades in a pack of 52 cards

$\therefore$ Favourable outcomes = 13.

P(spade) =

$$\frac{\text{No. of favourable outcomes}}{\text{Total number of possible outcomes}} = \frac{13}{52} = \frac{1}{4}$$

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

$\therefore$ Number of favourable outcomes = 1

P(queen of diamonds) =

$$\frac{\text{No. of favourable outcomes}}{\text{Total number of possible outcomes}} = \frac{1}{52}$$

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?

(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?

Sol. (i) There is only one queen out of the five cards.

There, P(getting queen) = $\frac{1}{5}$

(ii) When queen is drawn, four cards are left which are a ten, a jack, a king and an ace.

(a) P(an ace) = $\frac{1}{4}$

(b) P(a queen) = $\frac{0}{4} = 0$

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.

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

$\therefore$ Total number of pens = 132 + 12 = 144

Total possible outcomes = 144

There are 132 good pens

$\therefore$ Number of favourable outcomes = 132

P(good pens) =

$$\frac{\text{No. of favourable outcomes}}{\text{Total number of possible outcomes}} = \frac{132}{144} = \frac{11}{12}$$

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?

(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?

Sol. (i) P (Bulb drawn is defective) = $\frac{4}{20}=\frac{1}{5}$

(ii) When a good bulb is drawn out from the 20 bulbs, then there are 4 defective and 15 good bulbs left in the remaining 19 bulbs. Now, P (Bulbs drawn out of 19 bulbs is not defective) = $\frac{15}{19}$

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.

(ii) a perfect square number.

(iii) a number divisible by 5.

Sol. We have total number of discs = 90

$\therefore$ Total number of possible outcomes = 90

(i) Since, two-digit numbers are 10, 11, 12, ... 90.

$\therefore$ Number of two-digit numbers = 90 – 9 = 81

Number of favourable outcomes = 81

$\therefore$ P(Two digit number) =

$$\frac{\text{No. of favourable outcomes}}{\text{Total number of possible outcomes}}=\frac{81}{90}=\frac{9}{10}$$

(ii) Perfect square from 1 to 90 are 1, 4, 9, 16, 25, 36, 49, 64 and 81.

$\therefore$ Number of perfect squares = 9

Number of favourable outcomes = 9

$\therefore$ P(Perfect square) =

$$\frac{\text{No. of favourable outcomes}}{\text{Total number of possible outcomes}}=\frac{9}{90}=\frac{1}{10}$$

(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.

$\therefore$ Numbers of favourable outcomes = 18

P(Numbers divisible by 5)=

$$\frac{\text{No. of favourable outcomes}}{\text{Total number of possible outcomes}}=\frac{18}{90}=\frac{1}{5}$$

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?

Sol. Since, there are six faces of the given die and these faces are marked with letters

A	B	C	D	E	A

$\therefore$ Total number of letters = 6

(i) Two faces are having the letter A.

$\therefore$ Number of favourable outcomes = 2

Now, P(letter A) =

$$\frac{\text{No. of favourable outcomes}}{\text{Total number of possible outcomes}}=\frac{2}{6}=\frac{1}{3}$$

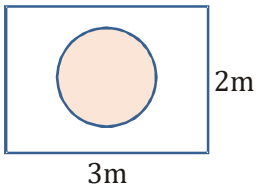
(ii) Number of D's = 1

$\therefore$ Number of possible outcomes = 1

$\Rightarrow$ P(letter D) =

$$\frac{\text{No. of favourable outcomes}}{\text{Total number of possible outcomes}}=\frac{1}{6}$$

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



Sol. Area of the rectangle = $3m \times 2m = 6m^2$

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

Probability (die will land inside the circle)

$= \frac{\pi/4}{6} = \frac{\pi}{24}$

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

(ii) She will not buy it ?

Sol. 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

$\therefore$ 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. Two dice are thrown at the same time.

(i) Complete the following table

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

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

Sol. $\because$ 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)

Here number of all possible outcomes is

$6 \times 6 = 36$

(i) (a) ∵ The sum on two dice is 3 for

(1, 2) and (2, 1)

∴ Favourable outcomes = 2

$\Rightarrow P(3) = \frac{2}{36} = \frac{1}{18}$

(b) ∵ The sum on two dice is 4 for

(1, 3), (2, 2) and (3, 1).

∴ Number of favourable outcomes = 3

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

(c) ∵ The sum on two dice is 5 for

(1, 4), (2, 3), (3, 2) and (4, 1)

∴ Number of favourable outcomes = 4

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

(d) The sum on two dice is 6 for

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

∴ Number of favourable outcomes = 5

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

(e) The sum on two dice is 7 for

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

∴ Number of favourable outcomes = 6

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

(f) The sum on two dice is 9 for

(3, 6), (4, 5), (5, 4) and (6, 3)

∴ Number of favourable outcomes = 4

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

(g) The sum of two dice is 10 for

(4, 6), (5, 5), (6, 4)

∴ Number of favourable outcomes = 3

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

(h) The sum of two dice is 11 for (5, 6) and (6, 5)

∴ Number of favourable outcomes = 2

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

Thus, the complete table is as under.

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

(ii) No, the eleven sums are not equally likely.

∴ The argument is not correct.

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.

Sol. Possible outcomes are

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

i.e., in all 8 outcomes.

Out of these, 6 outcomes other than HHH and TTT favour the event E than Hanif will lose the game.

Therefore, P (Hanif will lose the game) = $\frac{6}{8}=\frac{3}{4}$

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

(i) 5 will not come up either time?

(ii) 5 will come up at least once?

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

$\therefore$ 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)

$\therefore$ All possible outcomes = 36

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

The favourable outcomes are

= [36 – (5 + 6)] = 25

$\therefore$ 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

$\therefore$ P(N) = $\frac{11}{36}$

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 $\frac{1}{3}$.

(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 $\frac{1}{2}$

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

$\therefore$ Probability = $\frac{1}{4}$.

(ii) Correct. Because the two outcomes are possible. Total outcomes = 6 and odd numbers = 3 and even numbers = 3. So, favourable outcomes = 3 (in both the cases even or odd).

$\therefore$ Probability = $\frac{3}{6}=\frac{1}{2}$