

23. Probability

EXERCISE 23

Question 1.

A die is thrown, find the probability of getting:

- (i) a prime number
- (ii) a number greater than 4
- (iii) a number not greater than 4.

Solution:

A die has six numbers : 1, 2, 3, 4, 5, 6

∴ Number of possible outcomes = 6

(i) a prime number

Number of favourable outcomes = a prime number = 1, 3, 5 which are 3 in numbers

$$P(E) = \frac{\text{Number of favourable outcome}}{\text{Number of all possible outcome}}$$

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

(ii) Number of favourable outcome = greater than four i.e. two number 5 and 6

$$\therefore P(E) = \frac{\text{Number of favourable outcome}}{\text{Number of all possible outcome}}$$

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

(iii) Number of favourable outcome = not greater than 4 or numbers will be 1, 2, 3, 4 which are 4 in numbers

$$\therefore P(E) = \frac{\text{Number of favourable outcome}}{\text{Number of all possible outcome}}$$

$$= \frac{4}{6} = \frac{2}{3}$$

Question 2.

A coin is tossed. What is the probability of getting:

(i) a tail? (ii) ahead?

Solution:

On tossing a coin once,

Number of possible outcome = 2

(i) Favourable outcome getting a tail = 1

⇒ number of favourable outcome = 2

$$\therefore P(E) = \frac{\text{Number of favourable outcome}}{\text{Number of all possible outcome}}$$

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

(ii) a head

Similarly, favourable outcome getting a head

= 1

But number of possible outcome = 2

$$\therefore P(E) = \frac{\text{Number of favourable outcome}}{\text{Number of all possible outcome}}$$

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

Question 3.

A coin is tossed twice. Find the probability of getting:

(i) exactly one head (ii) exactly one tail

(iii) two tails (iv) two heads

Solution:

(i) Exactly one head

Possible number of favourable outcomes = 2

(i.e. TH and HT)

Total number of possible outcomes = 4

$$\therefore P(E) = \frac{\text{Number of favourable outcomes}}{\text{Total number of possible outcomes}}$$

$$= \frac{2}{4} = \frac{1}{2}$$

(ii) Exactly one tail

Possible number of favourable outcomes = 2

(i.e. TH and HT)

Total number of possible outcomes = 4

$$P(E) = \frac{\text{Number of favourable outcomes}}{\text{Total number of possible outcomes}}$$
$$= \frac{2}{4} = \frac{1}{2}$$

(iii) Two tails

Possible number of favourable outcomes = 1

(i.e. TT)

Total number of possible outcomes = 4

$$\therefore P(E) = \frac{\text{Number of favourable outcomes}}{\text{Total number of possible outcomes}}$$
$$= \frac{1}{4}$$

(iv) Two heads

Possible number of favourable outcomes = 1

(i.e. HH)

Total number of possible outcomes = 4

$$\therefore P(E) = \frac{1}{4}$$

Question 4.

A letter is chosen from the word 'PENCIL' what is the probability that the letter chosen is a consonant?

Solution:

Total no. of letters in the word 'PENCIL' = 6

Total Number of Consonant = 'PNCL' i.e. 4

$P(E) =$

$$\frac{\text{Total No. of consonants}}{\text{Total No. of letters in the word PENCIL}}$$

$$= \frac{4}{6} = \frac{2}{3}$$

Question 5.

A bag contains a black ball, a red ball and a green ball, all the balls are identical in shape and size. A ball is drawn from the bag without looking into it. What is the probability that the ball drawn is:

- (i) a red ball
- (ii) not a red ball
- (iii) a white ball.

Solution:

Total number of possible outcomes = 3

$$\therefore P(E) = \frac{1}{3}$$

- (ii) Not a red ball

$$\begin{aligned} \text{Number of favourable outcomes} \\ &= \text{Green ball} + \text{Black ball} \\ &= 1 + 1 + 2 \end{aligned}$$

$$\therefore P(E) = \frac{2}{3}$$

- (iii) A white ball

Number of favourable outcomes = 0

$$\therefore P(E) = \frac{0}{3} = 0$$

Question 6.

6. In a single throw of a die, find the probability of getting a number

- (i) greater than 2
- (ii) less than or equal to 2
- (iii) not greater than 2.

Solution:

A die has six numbers = 1, 2, 3, 4, 5, 6

- (i) Exactly one head

Possible number of favourable outcomes = 2

(i.e. TH and HT)

Total number of possible outcomes = 4

$$\therefore P(E) = \frac{\text{Number of favourable outcomes}}{\text{Total number of possible outcomes}}$$

$$= \frac{2}{4} = \frac{1}{2}$$

- (ii) Exactly one tail

Possible number of favourable outcomes = 2

(i.e. TH and HT)

∴ Number of possible outcomes = 6

$$\therefore P(E) = \frac{4}{6} = \frac{2}{3}$$

(ii) Less than or equal to 2

Number of favourable outcomes = 1, 2

$$\therefore P(E) = \frac{2}{6} = \frac{1}{3}$$

(iii) Not greater than 2

Number of favourable outcomes = 1, 2

$$\therefore P(E) = \frac{2}{6} = \frac{1}{3}$$

Question 7.

A bag contains 3 white, 5 black and 2 red balls, all of the same shape and size. A ball is drawn from the bag without looking into it, find the probability that the ball drawn is:

- (i) a black ball.
- (ii) a red ball.
- (iii) a white ball.
- (iv) not a red ball.
- (v) not a black ball.

Solution:

In a bag, 3 balls are white

2 balls are red

5 balls are black

Total number of balls = 3 + 2 + 5 = 10

- (i) Number of possible outcome of one black ball = 10
and number of favourable outcome of one black ball = 5

$$\begin{aligned}\therefore P(E) &= \frac{\text{Number of favourable outcome}}{\text{Number of all possible outcome}} \\ &= \frac{5}{10} = \frac{1}{2}\end{aligned}$$

- (ii) Number of possible outcome of one red ball = 10
and number of favourable outcome = 2

$$\begin{aligned}\therefore P(E) &= \frac{\text{Number of favourable outcome}}{\text{Number of all possible outcome}} \\ &= \frac{2}{10} = \frac{1}{5}\end{aligned}$$

- (iii) Number of possible outcome of white ball = 10
and number of favourable outcome = 3

$$\begin{aligned}\therefore P(E) &= \frac{\text{Number of favourable outcome}}{\text{Number of all possible outcome}} \\ &= \frac{3}{10}\end{aligned}$$

- (iv) Number of possible outcome = 10
Number of favourable outcome
= 3 + 5 = 8
not a red ball

$$\begin{aligned}\therefore P(E) &= \frac{\text{Number of favourable outcome}}{\text{Number of all possible outcome}} \\ &= \frac{8}{10} = \frac{4}{5}\end{aligned}$$

(v) Number of possible outcomes = 10
 Number of favourable outcome
 not a black ball = 3 + 2 = 5

$$\begin{aligned}\therefore P(E) &= \frac{\text{Number of favourable outcome}}{\text{Number of all possible outcome}} \\ &= \frac{5}{10} = \frac{1}{2}\end{aligned}$$

Question 8.

In a single throw of a die, find the probability that the number:

(i) will be an even number.

(ii) will be an odd number.

(iii) will not be an even number.

Solution:

A die has six numbers : 1, 2, 3, 4, 5, 6

\therefore Number of possible outcome = 6

(i) Number of favourable outcome = an even number i.e. 2, 4, 6 which are 3 in numbers

$$\begin{aligned}\therefore P(E) &= \frac{\text{Number of favourable outcome}}{\text{Number of all possible outcome}} \\ &= \frac{3}{6} = \frac{1}{2}\end{aligned}$$

(ii) & (iii) Number of favourable outcome
 = not an even number i.e. odd numbers
 : 1, 3, 5 which are 3 in numbers

$$\begin{aligned}\therefore P(E) &= \frac{\text{Number of favourable outcome}}{\text{Number of all possible outcome}} \\ &= \frac{3}{6} = \frac{1}{2}\end{aligned}$$

Question 9.

In a single throw of a die, find the probability of getting :

- (i) 8
- (ii) a number greater than 8
- (iii) a number less than 8

Solution:

On a die the numbers are 1, 2, 3, 4, 5, 6 i.e. six.

∴ Number of possible outcome = 6

(i) Number of favourable outcome = 0

(∵ 8 is not possible)

$$\therefore P(E) = \frac{\text{Number of favourable outcome}}{\text{Number of all possible outcome}}$$

$$= \frac{0}{6} = 0$$

(ii) Number greater than 8 will be 0

$$\therefore P(E) = \frac{\text{Number of favourable outcome}}{\text{Number of all possible outcome}}$$

$$= \frac{0}{6} = 0$$

(iii) Number less than 8 will be 1, 2, 3, 4, 5, 6

$$\therefore P(E) = \frac{\text{Number of favourable outcome}}{\text{Number of all possible outcome}}$$

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

Question 10.

Which of the following can not be the probability of an event?

(i) $\frac{2}{7}$

(ii) 3.8

(iii) 37%

(iv) -0.8

(v) 0.8

(vi) $\frac{-2}{5}$

(vii) $\frac{7}{8}$

Solution:

The probability of an event cannot be

(ii) 3.8 i.e. the probability of an even cannot exceed 1.

(iv) i.e. -0.8 and

(vi) -2/5, This is because probability of an even can never be less than 1.

Question 11.

A bag contains six identical black balls. A child withdraws one ball from the bag without looking into it. What is the probability that he takes out:

(i) a white ball,

(ii) a black ball

Solution:

∴ There are 6 black balls in a bag

∴ number of possible outcome = 6

(i) A white ball

As there is no white ball in the bag

∴ Its probability is zero (0) = or $P(E) = 0$

(ii) a black ball

∴ Number of favourable outcome = 1

$$\therefore P(E) = \frac{\text{Number of favourable outcome}}{\text{Number of all possible outcome}}$$

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

Question 12.

Three identical coins are tossed together. What is the probability of obtaining:
all heads?

exactly two heads?

exactly one head?

no head?

Solution:

Total outcomes = 8

i.e. (H, H, H), (H, H, T), (H, T, H), (T, T, T), (T, H, H), (T, T, H), (H, T, T), (T, H, T)

(i) Favourable outcome = *i.e.* (H, H, H)

$$\therefore P(\text{of getting all heads}) = \frac{1}{8}$$

(ii) Favourable outcomes = 3 (H, H, T), (H, T, H), (T, H, H)

$$\therefore P(E) = \frac{3}{8}$$

(iii) Favourable outcomes = 3 (H, T, H), (T, T, H), (H, T, T)

$$\therefore P(E) = \frac{3}{8}$$

(iv) Favourable outcomes = 1 *i.e.* (T, T, T)

$$\therefore P(E) = \frac{1}{8}$$

Question 13.

A book contains 92 pages. A page is chosen at random. What is the probability that the sum of the digits in the page number is 9?

Solution:

Number of pages of the book = 92

Which are from 1 to 92

Number of possible outcomes = 92

\therefore Number of pages whose sum of its page is 9 = 10

i.e. 9, 18, 27, 36, 45, 54, 63, 72, 81, 90

$$\therefore P(E) = \frac{10}{92} = \frac{5}{46}$$

Question 14.

Two coins are tossed together. What is the probability of getting:

- (i) at least one head
- (ii) both heads or both tails.

Solution:

∴ A coin has two faces Head and Tail or H, T

∴ Two coins are tossed

∴ Number of coins = $2 \times 2 = 4$

which are HH, HT, TH, TT

(i) At least one head, then

Number of outcomes = 3

$$\therefore P(E) = \frac{\text{Number of favourable outcome}}{\text{Number of all possible outcome}}$$

$$= \frac{3}{4}$$

(ii) When both head or both tails, then

Number of outcomes = 2

$$\therefore P(E) = \frac{\text{Number of favourable outcome}}{\text{Number of all possible outcome}}$$

$$= \frac{2}{4} = \frac{1}{2}$$

Question 15.

From 10 identical cards, numbered 1, 2, 3, , 10, one card is drawn at random. Find the probability that the number on the card drawn is a multiple of:

- (i) 2 (ii) 3
(iii) 2 and 3 (iv) 2 or 3

Solution:

Total outcomes = 10

i.e. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

(i) Favourable outcomes = 5 i.e. 2, 4, 6, 8, 10

$$P(E) = \frac{5}{10} = \frac{1}{2}$$

(ii) Favourable outcomes = 3 i.e. 3, 6, 9

$$P(E) = \frac{3}{10}$$

(iii) Favourable outcomes = 1 i.e. 6

$$P(E) = \frac{1}{10}$$

(iv) Favourable outcomes = 7

i.e. 2, 3, 4, 6, 8, 9, 10

$$P(E) = \frac{7}{10}$$

Question 16.

Two dice are thrown at the same time. Find the probability that the sum of the two numbers appearing on the top of the dice is:

- (i) 0
(ii) 12
(iii) less than 12
(iv) less than or equal to 12

Solution:

Total outcomes = 36 i.e.

(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)

(i) Favourable outcomes = 0

$$P(E) = \frac{0}{36} = 0$$

(ii) Favourable outcomes = 1 i.e. (6, 6)

$$P(E) = \frac{1}{36}$$

(iii) Favourable outcomes = 35 [Except (6, 6)]

$$P(E) = \frac{35}{36}$$

(iv) Favourable outcomes = 36

$$P(E) = \frac{36}{36} = 1$$

Question 17.

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

(i) a prime number

(ii) a number greater than 3

(iii) a number other than 3 and 5

(iv) a number less than 6

(v) a number greater than 6.

Solution:

Total outcomes = 6

i.e., 1, 2, 3, 4, 5 and 6

(i) Favourable outcomes = 3 i.e., 2, 3, 5

$$P(E) = \frac{3}{6} = \frac{1}{2}$$

(ii) Favourable outcomes = 3 i.e., 4, 5, 6

$$P(E) = \frac{3}{6} = \frac{1}{2}$$

(iii) Favourable outcomes = 4 i.e., 1, 2, 4, 6

$$P(E) = \frac{4}{6} = \frac{2}{3}$$

(iv) Favourable outcomes = 5

i.e., 1, 2, 3, 4, and 5

$$P(E) = \frac{5}{6}$$

(v) Favourable outcomes = 0

$$P(E) = \frac{0}{6} = 0$$

Question 18.

Two coins are tossed together. Find the probability of getting:

(i) exactly one tail

(ii) at least one head

(iii) no head

(iv) at most one head

Solution:

Total outcomes = 4

i.e., HH, HT, TT, TH

(i) Favourable outcomes = 2 i.e., HT and TH

$$P(E) = \frac{2}{4} = \frac{1}{2}$$

(ii) Favourable outcomes = 3

i.e., HH, HT and TH

$$P(E) = \frac{3}{4}$$

(iii) Favourable outcomes = 1 i.e., TT

$$P(E) = \frac{1}{4}$$

(iv) Favourable outcomes = 3

i.e., HH, HT and TH

$$P(E) = \frac{3}{4}$$