Long Answer Type Questions

[4 MARKS]

Que 1. 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. Here, total number of possible outcomes = 52
(i) As we know that there are two suits of red card, i.e., diamond and heart and each suit contains one king.

∴ Favourable number of outcomes = 2

∴ Probability of getting a king of red colour = $\frac{2}{52} = \frac{1}{26}$

(ii) As we know that kings, queen and jacks are called face cards. Therefore, there are 12 face cards.

∴ Favourable number of elementary events = 12

∴ Probability of getting a face card = $\frac{12}{52} = \frac{3}{13}$

(iii) As we know there are two suits of red cards, i.e., diamonds and heart and each suit contains 3 face cards.

∴ Favourable number of elementary events = $2 \times 3 = 6$

∴ Probability of getting red a face card = $\frac{6}{52} = \frac{3}{26}$.

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

∴ Favourable number of elementary events = 1

∴ Probability of getting the jack of heart = $\frac{2}{52}$.

(v) Since, there are 13 cards of spade.

∴ Favourable number of elementary events = 13

∴ Probability of getting a spade = $\frac{13}{52} = \frac{1}{4}$.

(vi) Since, there is only one queen of diamonds.

∴ Favourable number of outcomes (elementary events) = 1

∴ Probability of getting a queen of diamonds = $\frac{1}{52}$.

Que 2. One card is drawn from a pack of 52 cards, each of the 52 cards being equally likely to be drawn. Find the probability that the card drawn is:
(i) an ace. **(ii) red.** **(iii) either red or king.**
(iv) red and a king. **(v) a face card.** **(vi) a red face card.**
(vii) '2' of spades. **(viii) '10' of a black suit.**

Sol. Out of 52 cards, one card can be drawn in 52 ways.
So, total number of elementary events = 52

(i) There are four ace cards in a pack of 52 cards. So, one ace can be chosen is 4 ways.

∴ Favourable number of elementary events = 4

Hence, required probability = $\frac{4}{52} = \frac{1}{13}$.

(ii) There are 26 red cards in a pack of 52 cards. Out of 26 red cards, one card can be chosen in 26 ways.

∴ Favourable number of elementary events = 26

Hence, required probability = $\frac{26}{52} = \frac{1}{2}$

(iii) There are 26 red cards, including two red kings, in a pack of 52 playing cards. Also there are 4 kings, two red and black. Therefore, card drawn will be a red card or a king if it is any one of 28 cards (26 red cards and 2 black kings).

∴ Favourable number of elementary events = 28

Hence, required probability = $\frac{28}{52} = \frac{7}{13}$.

(iv) A card drawn will be red as well as king. If it is a red king. There are kings in a pack of 52 playing cards.

∴ Favourable number of elementary events = 2

Hence, required probability = $\frac{2}{52} = \frac{1}{26}$.

(v) In a deck of 52 cards: kings, queens and jacks are called face cards. Thus, there are 12 face cards. So, one face card can be chosen in 12 ways.

∴ Favourable number of elementary events = 12

Hence, required probability = $\frac{12}{52} = \frac{3}{13}$.

(vi) There are 6 red face cards 3 each from diamonds and hearts. Out of these 6 red cards, one card can be chosen in 6 ways.

∴ Favourable number of elementary events = 6

Hence, required probability = $\frac{6}{52} = \frac{3}{26}$.

(vii) There is only ‘2’ of spades.

∴ Favourable number of elementary events = 1

Hence, required probability = $\frac{1}{52}$.

(viii) There are two suits of black cards viz. Spades and clubs. Each suit contains one card bearing number 10.

∴ Favourable number of elementary events = 2

Hence, required probability = $\frac{2}{52} = \frac{1}{26}$.

Que 3. 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. 15.2), and these are equally likely outcomes. What is the probability that it will point at:
(i) 8?
(ii) an odd number?
(iii) a number less than 2?
(iv) a number less than 9?

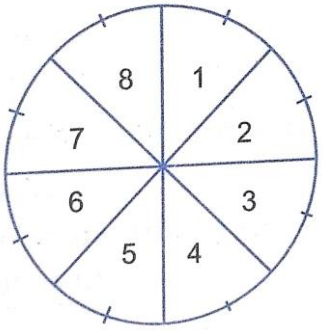


Fig. 15.2

Sol. Here, total number of elementary events (possible outcomes) = 8

(i) We have only one '8' on the spinning plant.

∴ Favourable number of outcomes = 1

Hence, the probability that arrow points at $8 = \frac{1}{8}$.

(ii) We have four odd points (i.e., 1, 3, 5 and 7)

∴ Favourable number of outcomes = 4

∴ Probability that arrow points at an odd number = $\frac{4}{8} = \frac{1}{2}$.

(iii) We have 6 numbers greater than 2, i.e., 3, 4, 5, 6, 7 and 8.

Therefore, favourable number of outcomes = 6

∴ Probability that arrow points at a number greater than $2 = \frac{6}{8} = \frac{3}{4}$.

(iv) We have 8 numbers less than 9, i.e., 1, 2, 3… 8.

∴ Favourable number of outcomes = 8

∴ Probability that arrow points at a number less than $9 = \frac{8}{8} = 1$.

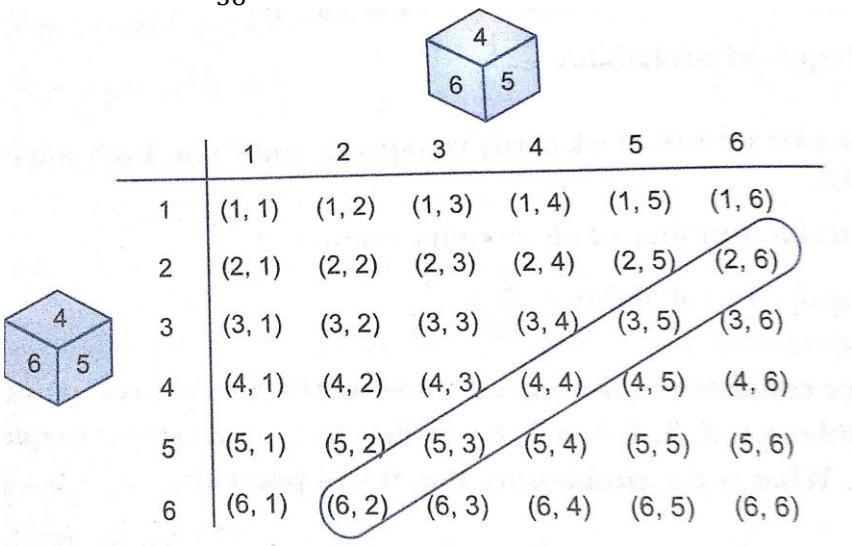
Que 4. Two dice, one blue and one grey, are thrown at the same time. Write down all the possible outcomes. What is the probability that the sum of the two numbers appearing on the top of the dice is:
(i) 8? (ii) 13? (iii) less than or equal to 12?

Sol. When the blue die shows '1' the grey die could show any one of the numbers 1, 2, 3, 4, 5, 6. The same is true when the blue die shows '2', '3', '4', '5' or '6'. The possible outcomes of the experiment are listed in the table below; the first number in each ordered pair is the number appearing on the blue die and the second number is that on the grey die.

So, the number of possible outcomes = 6 × 6 = 36.
(i) The outcomes favourable to the event 'the sum of the two number is 8' denoted by E, are:

(2, 6), (3, 5), (4, 4), (5, 3), (6, 2) (see figure)
i.e., the number of outcomes favourable to E = 5.

Hence, P (E) = $\frac{5}{36}$



(ii) As you can see from figure, there is no outcome favourable to the event F, 'the sum of two numbers is 13'.

So, P (F) = $\frac{0}{36} = 0$

(iii) As you can see from figure, all the outcomes are favourable to the event G, 'sum of two numbers $\leq 12'$.

So, P (G) = $\frac{36}{36} = 1$.

Que 5. A bag contains cards numbered from 1 to 49. A card is drawn from the bag at random, after mixing the cards throughly. Find the probability that the number on drawn card is:
(i) an odd number. **(ii) a multiple of 5.**
(iii) a perfect square. **(iv) an even prime number.**

Sol. Total number of cards = 49
Total number of outcomes = 49
(i) Odd number
Favourable outcomes 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39, 41, 43, 45, 47, 49

Number of favourable outcomes = 25

Probability (E) = $\frac{No.of\ favourable\ outcomes}{Total\ number\ of\ outcomes}$

$$= \frac{25}{49}$$

(ii) A multiple of 5

Favourable outcomes: 5, 10, 15, 20, 25, 30, 35, 40, 45

Number of favourable outcomes = 9

$$\text{Probability (E)} = \frac{No.of\ favourable\ outcomes}{Total\ number\ of\ outcomes}$$

$$= \frac{9}{49}$$

(iii) A perfect square

Favourable outcomes: 1, 4, 9, 16, 25, 36, 49

Number of favourable outcomes = 7

$$\text{Probability (E)} = \frac{No.of\ favourable\ outcomes}{Total\ number\ of\ outcomes}$$

$$= \frac{7}{49} = \frac{1}{7}$$

(iv) An even prime number

Favourable outcomes = 2

Number of favourable outcomes = 1

$$\text{Probability (E)} = \frac{No.of\ favourable\ outcomes}{Total\ number\ of\ outcomes}$$

$$= \frac{1}{49}$$

Que 6. All the black face cards are removed from a pack of 52 playing cards. The remaining cards are well shuffled and then a card is drawn at random. Find the probability of getting a: (i) face card. (ii) red card.
(iii) black card. (iv) king.

Sol. cards remaining after removing black face cards = red cards + black cards excluding face cards

= 26 + 20 = 46

Total number of possible outcomes = 46

(i) Face Card Favourable outcomes: 6 red face cards (king, queen and jack of diamond and heart suits)

$$\text{Probability (E)} = \frac{No.of\ favourable\ outcomes}{Total\ number\ of\ outcomes}$$

$$= \frac{6}{46} = \frac{3}{23}$$

(ii) Red Card No. of favourable outcomes: 26 (13 – 13 cards of heart and diamond suits)

$$\text{Probability (E)} = \frac{No.of\ favourable\ outcomes}{Total\ number\ of\ outcomes}$$

$$= \frac{26}{46} = \frac{13}{23}$$

(iii) Black Card No. of favourable outcomes: 20 (10 – 10 cards of club and spade suits)

$$\text{Probability (E)} = \frac{No.of\ favourable\ outcomes}{Total\ number\ of\ outcomes}$$

$$= \frac{20}{46} = \frac{10}{23}$$

(iv) King No. of favourable outcomes: 2 (king of heart and diamond suits)

$$\text{Probability (E)} = \frac{No.of\ favourable\ outcomes}{Total\ number\ of\ outcomes} = \frac{2}{46} = \frac{1}{23}$$

Que 7. Cards numbered from 11 to 60 are kept in a box. If a card is drawn at random from the box, find the probability that the number on the drawn card is:
(i) an odd number. **(ii) a perfect square number.**
(iii) divisible by 5. **(iv) a prime number less than 20.**

Sol. No. of possible outcomes = 60 – 11 + 1 = 50.
(i) An odd number
Favourable outcomes: 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39, 41, 43, 45, 47, 49, 51, 53, 55, 57, 59

No. of favourable outcomes = 25

$$\text{Probability (E)} = \frac{No.of\ favourable\ outcomes}{Total\ number\ of\ outcomes}$$

$$= \frac{25}{50} = \frac{1}{2}$$

(ii) A perfect square number
Favourable outcomes: 16, 25, 36, 49
No. of favourable outcomes = 04

$$\text{Probability (E)} = \frac{No.of\ favourable\ outcomes}{Total\ number\ of\ outcomes}$$

$$= \frac{4}{50} = \frac{2}{25}$$

(iii) Divisible by 5
Favourable outcomes: 15, 20, 25, 30, 35, 40, 45, 50, 55, 60
No. of favourable outcomes = 10

$$\text{Probability (E)} = \frac{No.of\ favourable\ outcomes}{Total\ number\ of\ outcomes}$$

$$= \frac{10}{50} = \frac{1}{5}$$

(iv) A prime number less than 20

Favourable outcomes: 11, 13, 17, 19

No. of favourable outcomes = 4

Probability (E) = $\frac{No.of\ favourable\ outcomes}{Total\ number\ of\ outcomes}$

$= \frac{4}{50} = \frac{2}{25}$

Que 8. A number x is selected at random from the numbers 1, 2, 3 and 4. Another number y is selected at random from the numbers 1, 4, 9 and 16. Find the probability that product of x and y is less than 16.

Sol. x can be any one of 1, 2, 3 or 4.

y can be any one of 1, 4, 9 or 16

Total number of cases of product of x and y = 16

Product less than 16 = (1×1, 1×4, 1×9, 2×1, 2×4, 3×1, 3×4, 4×1)

Number of cases, where product is less than 16 = 8

∴ Required probability = $\frac{8}{16}\ or\ \frac{1}{2}$

Que 9. In Fig. 15.3, shown a disc on which a player spins an arrow twice. The function $\frac{a}{b}$ is formed, where 'a' is the number of sector on which arrow stops on the first spin and 'b' is the number of the sector in which the arrow stops on second spin. On each spin, each sector has equal chance of selection by the arrow. Find the probability that the fraction $\frac{a}{b}$ > 1.

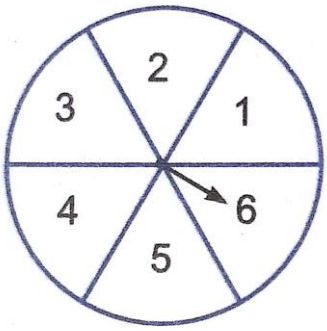


Fig. 15.3

Sol. For a/b > 1, when a = 1, b can not take any value,

a = 2, b can take 1 value,

a = 3, b can take 2 values,

a = 4, b can take 3 values,

a = 5, b can take 4 values,

a = 6, b can take 5 values.

Total possible outcomes = 36

$\therefore\ P(a/b > 1) = \frac{1+2+3+4+5}{36} = \frac{15}{36}\ or\ \frac{5}{12}$