Very Short Answer Type Questions

[1 Marks]

State true or false and give the reason for Q.1 to Q.4.

Que 1. If I toss a coin 3 times and get head each time, then I should expect a tail to have a higher chance in the 4th toss.

Sol. False, because the outcomes 'head' and 'tail' are equally, likely. So, every time the probability of getting head or tail is $\frac{1}{2}$.

Que 2. A bag contains slips numbered from 1 to 100. If Fatima chooses a slip at random from the bag, it will either be an odd number on an even number. Since, this situation has only two possible outcomes, so the probability of each is $\frac{1}{2}$.

Sol. True, because the outcomes 'odd number' and 'even number' are equally, likely here.

Que 3. In a family, having three children, there may be no girl, one girl, two girls or three girls. So, the probability of each is $\frac{1}{4}$.

Sol. False, because the outcomes are not equally, likely. For no girl, outcomes is bbb, for one girl, it is bgb, gbb, bbg, for two girls, it is bgg, ggb, gbg and for all girls, it is ggg.

Que 4. A game consists of spinning an arrow which comes to rest pointing at one of the regions (1, 2 or 3) (Fig. 15.1). The outcomes 1, 2 and m are equally, likely to occur.

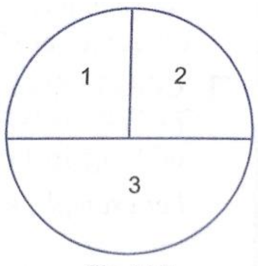


Fig. 15.1

Sol. False, because the outcome 3 is more likely than the other numbers.

Que 5. Two coins are tossed simultaneously. Find the probability of getting exactly one head.

Sol. Possible outcomes are {HH, HT, TH, TT}.

$$P\text{ (exactly one head)} = \frac{2}{4} = \frac{1}{2}$$

Que 6. From a well shuffled pack of cards, a card is drawn at random. Find the probability of getting a black queen.

Sol. Number of black queens in a pack of cards = 2

$\therefore \quad P\ (black\ queen)\ = \frac{2}{52} = \frac{1}{26}$

Que 7. If P (E) = 0.05, what is the probability of 'not E'?

Sol. As we know that,

P (E) + P (not E) = 1

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

Que 8. What is the probability of getting no head when two coins are tossed simultaneously?

Sol. Favourable outcomes is TT;

$\therefore \quad P\ (no\ head)\ = \frac{1}{4}$

Que 9. In a single throw of a pair of dice, what is the probability of getting the sum a perfect square?

Sol. Total outcomes = 36

Favourable outcomes are {(1, 3), (3, 1), (2, 2), (3, 6), (6, 3), (4, 5), (5, 4)}

$\therefore$ Required probability = $\frac{7}{36}$

Que 10. Someone is asked to choose a number from 1 to 100. What is the probability of it being a prime number?

Sol. Total prime number between 1 to 100 = 25

$\therefore$ P (prime number) = $\frac{25}{100} = \frac{1}{4}$

Que 11. Cards marked with number 3, 4, 5,… 50 are placed in a box and mixed thoroughly. A card is drawn at random from the box. Find the probability that the selected card bears a perfect square number.

Sol. Possible outcomes are 4, 9, 16, 25, 36, 49, i.e., 6.

$\therefore$ P (Perfect square number) = $\frac{6}{48}\ or\ \frac{1}{8}$

Que 12. A card is drawn ar random from a well shuffled pack of 52 playing cards. Find the probability of getting neither a red card nor a queen.

Sol. Number of possible outcomes = 52

Number of red cards and queens = 28

Number of favourable outcomes = 52 – 28 = 24

P (getting neither a red card nor a queen) = $\frac{24}{52} = \frac{6}{13}$

Que 13. 20 tickets, on which numbers 1 to 20 are written, are mixed thoroughly and then a ticket is drawn at random out of them. Find the probability that the number on the drawn ticket is a multiple of 3 of 7.

Sol. n (s) = 20, Multiples of 3 or 7, A: {3, 6, 9, 12, 15, 18, 7, 14}, n (A) = 8

∴ Required probability = $\frac{8}{20} or \frac{2}{5}$

Short Answer Type Questions – I

[2 marks]

Que 1. Two dice are thrown at the same time and the product of numbers appearing on them is noted. Find the probability that the product is a prime number.

Sol. Product of the number on the dice prime number, i.e., 2, 3, 5.

The possible ways are, (1, 2), (2, 1), (1, 3), (3, 1), (5, 1), (1, 5)

So, number of possible ways = 6

∴ Required probability = $\frac{6}{36} = \frac{1}{6}$

Que 2. Find the probability that a number selected from the number 1 to 25 is not a prime number when each of the given numbers is equally likely to be selected.

Sol. Total prime numbers from 1 to 25 = 9.

∴ Non-prime numbers from 1 to 25 = 25 – 9 = 16.

⇒ P (non-prime number) = $\frac{16}{25}$

Que 3. One card is drawn at random from a pack of 52 cards. Find the probability that the card drawn is an ace and black.

Sol. Number of black aces in a pack of cards = 2

Number of black aces in a park of cards = 2

∴ P (an ace and black) = $\frac{2}{52} = \frac{1}{26}$

Que 4. A card is drawn at random from a pack of 52 playing cards. Find the probability that the card drawn is neither an ace nor a king.

Sol. Let E be the event card drawn is neither an ace nor a king.
Then, the number of outcomes favourable to the event E = 44 (4 kings and 4 aces are not there)

∴ P (E) = $\frac{44}{52} = \frac{11}{13}$

Que 5. 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) As the bag contains only lemon flavoured candies. So, the event related to the experiment of taking out an orange flavoured candy is an impossible event. So, its probability is 0.
(ii) As the bag contains only lemon flavoured candies. So, the event related to the experiment of taking out lemon flavoured candies is certain event. So, its probability is 1.

Que 6. 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. Here, total number of pens = 132 + 12 = 144

∴ Total number of elementary outcomes = 144

Now, favourable number of elementary events = 132

∴ Probability that a pen taken out is good one = $\frac{132}{144} = \frac{11}{12}$.

Que 7. Two players, Sangeeta and Reshma, play a tennis match. It is known that the probability of Sangeeta's winning the match is 0.62. What is the probability of Reshma's winning the match?

Sol. Let S and R denote the events that Sangeeta and Reshma wins the match, respectively.

The probability of Sangeeta's winning = P (s) = 0.62

As the events R and S are complementary

∴ The probability of Reshma's winning = P (R) = 1 – P (S)

= 1 – 0.62 = 0.38.

Que 8. A child has a die whose six faces show the letter 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. The total number of elementary events associated with random experiment of throwing a die is 6.
(i) Let E be the event of getting a letter A.

∴ Favourable number of elementary events = 2

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

(ii) Let E be the event of getting a letter D.

∴ Favourable number of elementary events = 1

∴ $P\ (E) = \frac{1}{6}$.

Que 9. A card is drawn at random from a pack of 52 playing cards. Find the probability that the card drawn is neither a red card nor a black king.

Sol. Let E the event 'card drawn is neither a red card nor a black kind'
The number of outcomes favourable to the event E = 24 (26 red cards and 2 black kings are not there, so 52 – 28 = 24)

$$\therefore\ P\ (E) = \frac{24}{52} = \frac{6}{13}.$$

Que 10. Out of 400 bulbs in a box, 15 bulbs are defective. One bulb is taken out at random from the box. Find the probability that the drawn bulb is not defective.

Sol. Total number of bulbs in the box = 400
Total number of defective bulbs in the box = 15
∴ Total number of non-defective bulbs in the box = 400 – 15 = 385

$$\text{P (bulb is not defective)} = \frac{Number\ of\ non{-}defective\ bulbs}{Total\ number\ of\ bulbs} = \frac{385}{400} = \frac{77}{80}$$

Que 11. Rahim tosses two different coins simultaneously. Find the probability of getting at least one tail.

Sol. The sample space is {HH, HT, TH, TT}
Total number of outcomes = 4
Outcomes for getting at least one tail is {HT, TH, TT}
Number of favourable outcomes = 3

$$\therefore \text{Probability of getting at least one tail} = \frac{Number\ of\ favourable\ outcomes}{Total\ number\ of\ outcomes}$$

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

Short Answer Type Questions – II

[3 marks]

Que 1. Harpreet tosses two different coins simultaneously (say, one is of ₹ 1 and other of ₹ 2). What is the probability that she gets at least one head?

Sol. When two coins are tossed simultaneously, the possible outcomes are (H, H), (H, T), (T, H), (T, T), which are all equally likely. Here (H, H) means head up on the first coin (say on ₹ 1) and head up on the second coin (₹ 2). Similarly (H, T) means head up on the first coin and tail up on the second coin and so on.
The outcomes favourable to the event E,' at least one head' are (H, H), (H, T) and (T, H).
So, the number of outcomes favourable to E is 3.

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

i.e., the probability that Harpreet gets at least one head is $\frac{3}{4}$**.**

Que 2. A game consists of tossing a one rupee coin 3 times and nothing its outcomes 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. The outcomes associated with this experiment are given by
HHH, HHT, HTH, THH, TTH, THT, HTT, TTT
∴ Total number of possible outcomes = 8
Now, Hanif will lose the game if he gets
HHT, HTH, THH, TTH, THT, HTT
∴ Favourable number of events = 6
∴ Probability that he lose the game = $\frac{6}{8} = \frac{3}{4}$

Que 3. Three unbiased coins are tossed together. Find the probability of getting:

(i) all heads. **(ii) exactly two heads.**
(iii) exactly one head. **(iv) at least two heads.**
(v) at least two tails

Sol. Elementary events associated to random experiment of tossing three coins are
HHH, HHT, HTH, THH, HTT, THT, TTH, TTT
∴ Total number of elementary events = 8.
(i) The event "getting all heads" is said to occur, if the elementary event HHH occurs, i.e., HHH is an outcomes.

∴ Favourable number of elementary events = 1

Hence, required probability = $\frac{1}{8}$

(ii) The event "getting two heads" will occur, if one of the elementary events HHT, THH, HTH occurs.
∴ Favourable number of elementary events = 3

Hence, required probability = $\frac{3}{8}$

(iii) The event of "getting one head". When three coins are tossed together, occur if one of the elementary events HTT, THT, TTH, occurs.
∴ Favourable number of elementary events = 3

Hence, requited probability = $\frac{3}{8}$.

(iv) If any of the elementary events HHH, HHT, HTH and THH is a outcomes, then we say that the event "getting at least two heads" occurs.
∴ Favourable number of elementary events = 4

Hence, required probability = $\frac{4}{8} = \frac{1}{2}$.

(v) Similar as (iv) P (getting at least two tails) = $\frac{4}{8} = \frac{1}{2}$

Que 4. 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.

Sol. We have, the total number of possible outcomes associated with the random experiment of throwing a die is 6 (i.e., 1, 2, 3, 4, 5, 6).
(i) Let E denotes the event of getting a prime number.
So, favourable number of outcomes = 3 (i.e., 2, 3, 5)

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

(ii) Let E be the event of getting a number lying between 2 and 6.
∴ Favourable number of elementary events (outcomes) = 3 (i.e., 3, 4, 5)

∴ $P(E) = \frac{3}{6} = \frac{1}{2}$

(iii) Let be the event of getting an odd number.
∴ Favourable number of elementary events = (i.e., 1, 3, 5)

∴ P (E) = $\frac{3}{6} = \frac{1}{2}$

Que 5. Suppose we throw a die once. (i) What is the probability of getting a number greater that 4?

Sol. (i) Here, let E be the event 'getting a number greater than 4'. The number of possible outcomes are six: 1, 2, 3, 4, 5 and 6, and the outcomes favourable to E. are 5 and 6. Therefore, the number of outcomes favourable to E is 2. So,

P (E) = P (number greater than 4) = $\frac{2}{6} = \frac{1}{3}$

(ii) Let F be the event 'getting a number less than or equal to 4'.

Number of possible outcomes = 6
outcomes favourable to the event F are 1, 2, 3, 4.
So, the number of outcomes favourable to F is 4.

Therefore, P (F) = $\frac{4}{6} = \frac{2}{3}$

Que 6. One card is drawn from a well-shuffled deck of 52 cards. Calculate the probability that the card will:
(i) be an ace. (ii) not be an ace.

Sol. Well-shuffling ensures equally likely outcomes.

(i) There are 4 aces in a deck. Let E be the event 'the card is an ace'.
The number of outcomes favourable to E = 4.
The number of possible outcomes = 52

Therefore, P (E) = $\frac{4}{52} = \frac{1}{13}$.

(ii) Let $\overline{E}$ be the event 'card drawn is not an ace'.
The number of outcomes favourable to the event $\overline{E}$ = 52 – 4 = 48.
The number of possible outcomes = 52.

Therefore, P $\overline{E}$ = $\frac{48}{52} = \frac{12}{13}$.

Que 7. 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. Here, the total number of possible outcomes = 5.

(i) Since, there is only one queen
∴ Favourable number of elementary events = 1
∴ Probability of getting the card of queen = $\frac{1}{5}$.

(ii) Now, the total number of possible outcomes = 4.

(a) Since, there is only one ace

∴ Favourable number of elementary events = 1

∴ Probability of getting an ace card = $\frac{1}{4}$.

(b) Since, there is on queen (as queen is put aside)

∴ Favourable number of elementary events = 0

∴ Probability of getting a queen = $\frac{0}{4} = 0$.

Que 8. 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. Here, total number of marbles = 17.

∴ Total number of possible outcomes = 17.

(i) Since, there are 5 red marbles in the box.

∴ Favourable number of elementary events = 5

∴ Probability of getting red marble = $\frac{5}{17}$

(ii) Since, there are 8 white marbles in the box.

∴ Favourable number of elementary events = 8

∴ Probability of getting white marble = $\frac{8}{17}$

(iii) Since, there are 5 + 8 = 13 marbles which are not green in the box.

∴ Favourable number of elementary events = 13

∴ Probability of not getting a green marble = $\frac{13}{17}$

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.

$\therefore$ Favourable number of outcomes = 2

$\therefore$ 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.

$\therefore$ Favourable number of elementary events = 12

$\therefore$ 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.

$\therefore$ Favourable number of elementary events = 2 × 3 = 6

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

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

$\therefore$ Favourable number of elementary events = 1

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

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

$\therefore$ Favourable number of elementary events = 13

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

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

$\therefore$ Favourable number of outcomes (elementary events) = 1

$\therefore$ 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?

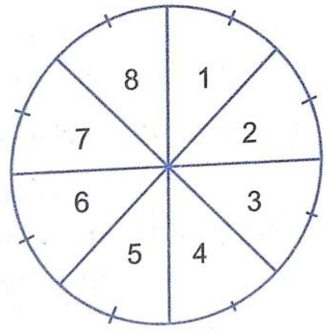


Fig. 15.2

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 $9 = \frac{8}{8} = 1$.

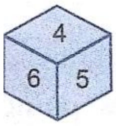
Que 4. Two dice, one blue and one grey, are thrown at the same time. Write down all the possible outcomes. What is the probability that the sum of the two numbers appearing on the top of the dice is:
(i) 8? **(ii) 13?** **(iii) less than or equal to 12?**

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) = $\frac{5}{36}$



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

(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)

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)

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)

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

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

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

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.

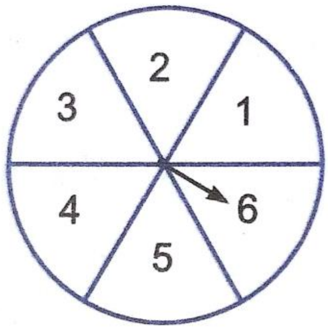


Fig. 15.3

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

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

HOTS (Higher Order Thinking Skills)

Que 1. 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. Let E be the event that first throw shows 5
and F be the event that second throw shows 5.

∴ $P(E) = \frac{1}{6} and\ P(F) = \frac{1}{6}$

Also, $P(\overline{E}) = 1 - P(E) = 1 - \frac{1}{6} = \frac{5}{6}$ and $P(\overline{F}) = 1 - P(F) = 1 - \frac{1}{6} = \frac{5}{6}$.

(i) Probability that 5 will not come up either time = $P(\overline{E}) \times P(\overline{F}) = \frac{5}{6} \times \frac{5}{6} = \frac{25}{36}$.

(ii) Probability that 5 will come up at least once = $1 - P(\overline{E}) \times P(\overline{F})$

$= 1 - \frac{25}{36} = \frac{36-25}{36} = \frac{11}{36}$

Que 2. Find the probability of getting 53 Fridays in a leap year.

Sol. Leap year = 366 days = (52 × 7 + 2) days = 52 weeks and 2 days.
Thus, a leap year always has 52 Fridays.
The remaining 2 days can be:
(i) Sunday and Monday
(ii) Monday and Tuesday
(iii) Tuesday and Wednesday
(iv) Wednesday and Thursday
(v) Thursday and Friday
(vi) Friday and Saturday
(vii) Saturday and Sunday

Out of there 7 cases, we have Fridays in two cases

∴ P (53 Fridays) = $\frac{2}{7}$.

Que 3. A bag contains 5 red balls and some blue balls. If the probability of drawing a blue ball from the bag is thrice that of a red ball, find the number of blue balls in the bag.

Sol. Let there be x blue balls in the bag.
∴ Total number of balls in bag = (5 + x)

Now, $P_1 = Probability\ of\ drawing\ a\ blue\ ball = \frac{x}{5+x}$

$P_2 = Probability\ of\ drawing\ a\ red\ ball = \frac{x}{5+x}$

We are given that,

$P_1 = 3 \times P_2 \quad \Rightarrow \quad \frac{x}{5+x} = 3 \times \frac{5}{5+x}$

$\Rightarrow \quad x(5+x) = 15(5+x)$

$\Rightarrow \quad$ x = 15

Hence, there are 15 blue balls in the bag.

Que 4. Apoorv throws two dice once and computes the product of the numbers appearing on the dice. Peehu throws one die and squares the number that appear on it. Who has the better chance of getting the number 36? Why?

Sol. Apoorv throws two dice once.

So, total number of outcomes, $n(S) = 36$.

Number of outcomes for getting product 36.

$n(E_1) = 1(6 \times 6)$

$\therefore$ Probability for Apoorv $= \frac{n(E_1)}{n(S)} = \frac{1}{36}$

Also, Peehu throw one die.

So, total number of outcomes n(S) = 6

Number of outcomes for getting square of a number is 36.

$n(E_2) = 1 \qquad (\because\ 6^2 = 36)$

$\therefore$ Probability for Peehu $= \frac{n(E_2)}{n(S)} = \frac{1}{6} = \frac{6}{36}$

Hence, Peehu has better chance of getting the number 36.

Value Based Questions

Que 1. The amount donated by some households in their religious organisation are as follow.

Amount (in ₹)	**Number of households**
Less than 100	14
Less than 200	22
Less than 300	37
Less than 400	58
Less than 500	67
Less than 600	75

Calculate the arithmetic mean for the above data.
What values do these households possess?

Sol.

Amount (in ₹)	$\boldsymbol{cf}$	$\boldsymbol{f_i}$	$\boldsymbol{x_i}$	$\boldsymbol{ui = \frac{xi - 250}{100}}$	$\boldsymbol{f_i u_i}$
0 – 100 100 – 200 200 – 300 300 – 400 400 – 500 500 – 600	14 22 37 58 67 75	14 8 15 21 9 8	50 150 **250** 350 450 550	– 2 – 1 0 1 2 3	– 28 – 8 0 21 18 24
Total		$\boldsymbol{\Sigma f_i = 75}$			27

By step deviation method

Arithmetic mean = $A + \frac{\Sigma f_i u_i}{\Sigma f_i} \times h = 250 + \frac{27}{75} \times 100 = \ 286$

Religion values, Helpfulness.

Que 2. Some people of a society decorated their area with flags and tricolour ribbons on Republic Days. The following data shows the number of person in different age group who participated in the decoration:

Age in years	5 – 15	15 – 25	25 – 35	35 – 45	45 – 55	55 – 65
Number of patients	6	11	21	23	14	5

Find the mode of the above data. What values do there persons possess?

Sol. $h = 10,\ f_1 = 23,\ f_0 = 21,\ f_2 = 14,\ l = 35$

Mode = $l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times h$

Mode = $35 + \frac{23-21}{46-35} \times 10 = 35 + \frac{20}{11} = 35 + 1.8 = 36.8$

National integrity, Unity, Beauty.

Que 3. The table below gives the distribution of villages under different height from sea level in a certain region.

Height in metres	200	600	1000	1400	1800	2200
No. of villages	142	265	560	271	89	16

(i) Compute the mean height of the region.
(ii) Which mathematical concept is used in this problem?
(iii) What is the value of village in modern times?

Sol. (i) Let the assumed mean A = 1400 and h = 400

Height $(x_i \text{ in metres})$	**No. of villages** f_i	$u_i = \frac{x_i - 1400}{400}$	$f_i u_i$
200	142	– 3	– 426
600	265	– 2	– 530
1000	560	– 1	– 560
1400	271	0	0
1800	89	1	89
2200	16	2	32
Total	$N = \Sigma f_i = 1343$		$\Sigma f_i u_i = -1395$

Mean = $A + \frac{\Sigma f_i u_i}{\Sigma f_i} \times h$

$= 1400 + 400 \times \frac{-1395}{1343} = 1400 - 415.49 = 984.51$

(ii) Mean by step deviation method.
(iii) Villages are important to keep a balance between the ecological problems.

Que 4. (i) Find the mean of children per family from data given below:

No. of children	0	1	2	3	4	5
No. of families	5	11	25	12	5	2

(ii) Which mathematical concept is used in this problem?
(iii) Which value is discussed here?

Sol. (i)

No. of children x_i	No. of families f_i	$f_i x_i$
0	5	0
1	11	11
2	25	50
3	12	36
4	5	20
5	2	10
Total	$\Sigma f_i = 60$	$\Sigma f_i x_i = 127$

Mean = $\frac{\Sigma f_i x_i}{\Sigma f_i} = \frac{127}{60} = 2.12\ (approx.)$

(ii) Mean of ungrouped data.
(iii) For progress, we should reduce the population growth.

Que 5. In a survey it was found that 40% people use petrol, 35% use diesel and remaining use CNG for their vehicles. Find the probability that a person chosen at random uses CNG.
Which fuel out of the above three is appropriate for the welfare of the society?

Sol. Percentage of people using CNG = 100 – (40 + 35) = 25%

P (Person using CNG) = $\frac{25}{100} = \frac{1}{4}$

CNG is useful as it does not leave unburnt carbon particles and also does not release other harmful gases which causes pollution in air.

Que 6. In a survey it was found that 30% of the population is using non-biodegradable products while the remaining is using biodegradable products. What is the probability that a person chosen at random uses non-biodegradable products? Which type of products should be used in a society for its proper development – biodegradable or non-biodegradable? Justify your answer.

Sol. P (Person using non-biodegradable products) = (100 – 30) %

$$= \frac{70}{100} = \frac{7}{10}$$

Biodegradable products are reusable and cause less pollution, so such products should be used.

Que 7. A school gives awards to the students of each class-5 for bravery, 3 for punctuality, 3 for full attendance, 4 for social service and 5 for self-confidence. An awarded student is selected at random. What is the probability that he/she is being awarded for (i) punctuality (i) self-confidence.
Which value out of the above five is most important for the development of society? Justify your answer.

Sol. Total awards given to each class = 5 + 3 + 3 + 4 + 5 = 20

(i) P (punctual students) = $\frac{3}{20}$

(ii) P (Self-confident students) = $\frac{5}{20} = \frac{1}{4}$

Any value with justification is correct. (Do yourself)

Que 8. Arushi, Mahi and Saina were fighting to get first chance in a game. Arushi says, "Let us toss two coins. If both heads appear, Mahi will take first chance, if both tails appear, Saina will get it and if one head and one tail appears, I will get the chance."
(i) What is the probability of Arushi getting the first chance?
(ii) Is her decision fair?
(iii) What quality of her character is being depicted here?

Sol. The sample space of the experiment of tossing two coins in $\{$HT, TH, HH, TT$\}$.
Outcomes favourable to Arushi are HT and HT.

(i) P (Arushi getting first chance) = $\frac{2}{4} = \frac{1}{2}$

(ii) No, the number of cases favourable to each one of them is not equal.
(iii) Dishonesty, as she kept two cases favourable to her and one each for the other two friends.