CHAPTER 15

Probability

EXAM DRILL

SOLUTIONS

1. **(b) :** Let E be the event that 'it will rain today'.
Given, $P(E) = 0.07$

$\therefore \quad P(\text{not } E) = 1 - P(E) \qquad [\because P(E) + P(\bar{E}) = 1]$
$= 1 - 0.07 = 0.93$

2. **(c) :** Numbers on a die are 1, 2, 3, 4, 5 and 6.
∴ Total number of possible outcomes = 6
Smallest odd prime number = 3
∴ Number of favourable outcome = 1
∴ P(getting smallest odd prime) = 1/6

3. **(c) :** Total number of fruits in the basket = 10
∴ Total number of possible outcomes = 10
Number of fruits not rotten = 10 – 3 = 7
∴ Number of favourable outcomes = 7
∴ Required probability = 7/10

4. **(a) :** Let E be the event of hitting the boundary.

$\therefore \quad P(E) = \frac{8}{40} = \frac{1}{5}$

$\Rightarrow \quad P(\text{not } E) = 1 - P(E) = 1 - \frac{1}{5} = \frac{5-1}{5} = \frac{4}{5}$

5. **(b) :** The total number of letters in the given word is 10.
∴ Total number of possible outcomes = 10
The number of consonants in the given word = 7
∴ Number of favourable outcomes = 7
∴ Required probability = 7/10

6. **(b) :** Number of letters in the word FOUNDATION is 10.
∴ Total number of possible outcomes = 10.
Repeated letters are O and N.
∴ Number of favourable outcomes = 2

$\therefore \quad \text{Required probability} = \frac{2}{10} = \frac{1}{5}$

7. **(a) :** Possible outcomes are 1, 2, 3, 4, 5 and 6.
∴ Total number of possible outcomes = 6
The factors of 36 are 1, 2, 3, 4, 6, 9, 12, 18 and 36.
Here, we see that 5 is not a factor of 36.
∴ Number of favourable outcome = 1
∴ Required probability = 1/6

8. In a deck of 52 cards, there are 13 cards of heart and 1 of them is ace of heart.
Hence, the number of outcomes favourable to E is 51.

9. Numbers on a die are 1, 2, 3, 4, 5 and 6.
∴ Total number of outcomes = 6
Odd number less than 3 is 1 only.
∴ Number of favourable outcome = 1
∴ Required probability = 1/6.

10. Possible outcomes are {HH, HT, TH, TT}, *i.e.*, 4 in number.

$P(\text{two heads}) = \frac{1}{4}, \; P(\text{one head}) = \frac{2}{4}$

∴ Ratio of the probability of two heads to one head

$= \frac{1}{4} : \frac{2}{4} = 1 : 2 \quad \therefore \; k = 2$

11. In a deck of 52 cards, there are 12 face cards *i.e.*, 6 red and 6 black cards.
So, probability of getting a red face card = 6/52 = 3/26

12. Total number of cards from 2 to 51 in a box are 51 – 1 = 50.
∴ Total number of possible outcomes = 50
Out of 50 possible outcomes, 25 outcomes *i.e.*, 2, 4, 6, 8, 10, ..., 50 are even numbers.
∴ Number of favourable outcomes = 25
∴ P(number on the drawn card is an even number)

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

13. Let E be the event sure to occur.
∴ $P(E) = 1$
∴ $P(\text{non-occurrence of } E) = P(\bar{E}) = 1 - P(E) = 1 - 1 = 0$

14. Given, P(A winning a game) = 0.7
∴ P(A losing the game) = 1 – P(A winning a game)
= 1 – 0.7 = 0.3

15. Total number of possible outcomes = 9
Numbers favourable to $|x| < 2$ are –1, 0 and 1 *i.e.*, 3 in number.

$\therefore \quad \text{Required probability} = \frac{3}{9} = \frac{1}{3}$

16. Total number of puppets in claw crane
= 58 + 42 + 36 + 64 = 200

(i) **(b) :** $P(\text{picking a tiger}) = \frac{36}{200} = \frac{9}{50}$

(ii) **(a) :** $P(\text{picking a monkey}) = \frac{64}{200} = \frac{8}{25}$

(iii) **(c) :** $P(\text{picking a teddy bear}) = \frac{58}{200} = \frac{29}{100}$

(iv) **(d) :** P(not picking a monkey)
= 1 – P(picking a monkey)

$= 1 - \frac{8}{25} = \frac{17}{25}$

(v) **(d) :** $P(\text{picking a pokemon}) = \frac{42}{200} = \frac{21}{100}$

$\therefore$ $P(\text{not picking a pokemon})$

$= 1 - P(\text{picking a pokemon})$

$= 1 - \frac{21}{100} = \frac{79}{100}$

17. Total time = 3 mins = 3 × 60 secs = 180 secs

(i) **(a) :** Required probability $= \frac{30}{180} = \frac{1}{6}$

(ii) **(a) :** Required probability $= \frac{45}{180} = \frac{1}{4}$

(iii) **(d) :** $P(\text{music will stop within 2 mins}) = \frac{120}{180} = \frac{2}{3}$

$\therefore$ $P(\text{music will stop after 2 mins}) = 1 - \frac{2}{3} = \frac{1}{3}$

(iv) **(b) :** Required probability = 1 – P(music will stop within first 60 secs)

$= 1 - \frac{60}{180} = 1 - \frac{1}{3} = \frac{2}{3}$

(v) **(b) :** Required probability $= \frac{82}{180} = \frac{41}{90}$

18. Total number of blocks in the kit = 120
Number of red blocks = 40
Number of blue blocks = 25
Number of green blocks = 30

$\therefore$ Number of yellow blocks = 120 – (40 + 25 + 30)
= 120 – 95 = 25

(i) $P(\text{block is red}) = \frac{40}{120} = \frac{1}{3}$

(ii) P(block is not yellow) = 1 – P(block is yellow)

$= 1 - \frac{25}{120} = 1 - \frac{5}{24} = \frac{19}{24}$

(iii) $P(\text{block is green}) = \frac{30}{120} = \frac{1}{4}$

(iv) $P(\text{block is yellow}) = \frac{5}{24}$

(v) P(block is not blue) = 1 – P(block is blue)

$= 1 - \frac{25}{120} = 1 - \frac{5}{24} = \frac{19}{24}$

19. Total number of possible outcome, $n(S) = 200$

(i) Let A be the event that number on selected card is divisible by 10.

$\therefore$ A = {10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180, 190, 200}

$\Rightarrow$ $n(A) = 20$

$\therefore$ $P(A) = \frac{n(A)}{n(S)} = \frac{20}{200} = \frac{1}{10}$

(ii) Let B be the event that the number on the selected card is a prime number more than 100 but less than 150.

$\therefore$ B = {101, 103, 107, 109, 113, 127, 131, 137, 139, 149}

$\Rightarrow$ $n(B) = 10$

$\therefore$ $P(B) = \frac{n(B)}{n(S)} = \frac{10}{200} = \frac{1}{20}$

(iii) Let C be the event that the number on the selected card is a multiple number of 3.

$\therefore$ C = {3, 6, 9, 12, ..., 192, 195, 198}

$\Rightarrow$ $n(C) = 66$

$\therefore$ $P(C) = \frac{n(C)}{n(S)} = \frac{66}{200} = \frac{33}{100}$

(iv) Let D be the event that the number on the selected card is a perfect square.

$\therefore$ D = {1, 4, 9, 16, 25, 36, 49, 64, 81, 100, 121, 144, 169, 196}

$\Rightarrow$ $n(D) = 14$

$\therefore$ $P(D) = \frac{n(D)}{n(S)} = \frac{14}{200} = \frac{7}{100}$

(v) Let E be the event that the number on the selected card is a perfect cube.

$\therefore$ E = {1, 8, 27, 64, 125}

$\Rightarrow$ $n(E) = 5$

$\therefore$ $P(E) = \frac{5}{200} = \frac{1}{40}$

20. Total number of possible outcomes = 36
Favourable outcomes are (1, 5), (2, 4), (3, 3), (4, 2), (5, 1) and (6, 6).

$\therefore$ Number of favourable outcomes = 6

$\therefore$ P(sum of two numbers will be multiple of 6)

$= \frac{6}{36} = \frac{1}{6}$

21. Given numbers are 1, 2, 3, ..., 30.

$\therefore$ Total number of possible outcomes = 30
Prime numbers greater than 5 from 1 to 30 are 7, 11, 13, 17, 19, 23, 29.

$\therefore$ Number of favourable outcomes = 7

$\therefore$ P(selecting a prime number greater than 5) = 7/30

22. Total number of envelopes in the box = 1000

$\therefore$ Total number of possible outcomes = 1000
Number of envelopes containing cash prize
= 10 + 100 + 200 = 310
So, number of envelopes containing no cash prize
= 1000 – 310 = 690

$\therefore$ Number of favourable outcomes = 690

$\therefore$ Required probability $= \frac{690}{1000} = 0.69$

23. Let E be the event of guessing correct answer.

$\therefore$ $P(E) = \frac{x}{12}$, $P(\bar{E}) = \frac{2}{3}$ [Given]

We know, $P(E) + P(\bar{E}) = 1$

$\Rightarrow \quad \frac{x}{12} + \frac{2}{3} = 1 \quad \Rightarrow \quad \frac{x}{12} = 1 - \frac{2}{3} = \frac{1}{3} \quad \Rightarrow \quad x = 4$

24. Total number of cards = 100 – 2 = 98

Let E be the event that the selected card bears a perfect square number.

$\therefore$ E = {4, 9, 16, 25, 36, 49, 64, 81, 100}

$\therefore$ Number of favourable outcomes = 9

$\therefore \quad P(E) = \frac{9}{98}$

25. For perfect square number, sum of numbers on both the dice should be 1 or 4 or 9.

Total number of outcomes = 36

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

Number of favourable outcomes = 7

$\therefore$ Required probability = 7/36

26. When a cube is thrown once, all possible outcomes are 2, 3, 5, 7, A, B.

$\therefore$ Total number of possible outcomes = 6

(i) Let E_1 be the event of getting an alphabet.

$\therefore$ Favourable outcomes are A, B.

$\therefore$ Number of favourable outcomes = 2

$\therefore \quad P(E_1) = \frac{2}{6} = \frac{1}{3}$

(ii) Let E_2 be the event of getting a prime number.

$\therefore$ Favourable outcomes are 2, 3, 5, 7.

$\therefore$ Number of favourable outcomes = 4

$\therefore \quad P(E_2) = \frac{4}{6} = \frac{2}{3}$

(iii) Let E_3 be the event of getting a consonant.

$\therefore$ Favourable outcome is B.

$\therefore$ Number of favourable outcome = 1

$\therefore$ $P(E_3) = 1/6$

27. The number x is selected from the numbers 1, 2, 3 and the number y is selected from the numbers 1, 4, 9.

Possible outcomes of the experiment are

(1, 1), (1, 4), (1, 9), (2, 1), (2, 4), (2, 9), (3, 1), (3, 4), (3, 9).

So, the total number of possible outcomes = 3 × 3 = 9

Let A be the event of getting $xy < 9$, then the outcomes favourable to A are (1, 1), (1, 4), (2, 1), (2, 4), (3, 1).

$\therefore$ Number of favourable outcomes = 5

$\therefore$ $P(A) = 5/9$

28. Area of the square $ABCD = (BC)^2 = 10^2 = 100\text{ cm}^2$

Side of square $PQRS$ = 5 cm

Now, area of the square $PQRS = (5)^2 = 25\text{ cm}^2$

$\therefore$ P(the point will be chosen from the shaded part)

$$= \frac{\text{Area of the square } PQRS}{\text{Area of the square } ABCD} = \frac{25}{100} = 0.25$$

29. If two unbiased coins are tossed simultaneously, then the possible outcomes are {HH, HT, TH, TT}

$\therefore$ Total number of possible outcomes = 4

No head is obtained if the event {TT} occurs.

$\therefore$ Number of favourable outcome = 1

$\therefore$ P(getting no head) = 1/4

But, given P(getting no head) = A/B

So, A = 1 and B = 4

$\therefore$ $(A + B)^2 = (1 + 4)^2 = (5)^2 = 25$

30. Given numbers are 2, 3, 3, 5, 5, 5, 7, 9, 20

Since the total numbers are 9, *i.e.*, an odd number of observations.

Therefore, median is the value of $\left(\frac{9+1}{2}\right)^{th}$ observation, *i.e.*, 5^{th} observation = 5

Total number of possible outcomes = 9

Let A denotes the event "the selected number is median".

Number of outcomes favourable to the event A are 3.

($\because$ 5 repeats 3 times)

Hence, $P(A) = \frac{3}{9} = \frac{1}{3}$

31. Total possible outcomes in spinning of an arrow twice = 6 × 6 = 36

So, favourable outcomes (a, b) for which $\frac{a}{b} > 1$ are {(2, 1), (3, 1), (3, 2), (4, 1), (4, 2), (4, 3), (5, 1), (5, 2), (5, 3), (5, 4), (6, 1), (6, 2), (6, 3), (6, 4), (6, 5)}

$\therefore$ Number of favourable outcomes = 15

$\therefore$ Required probability = 15/36 = 5/12

32. Total number of cards bearing numbers from 6 to 70 = 70 – 5 = 65

(i) Let E_1 denotes the event that card bears a one digit number. Then, numbers favourable to event E_1 are 6, 7, 8, 9.

$\therefore$ Number of favourable outcomes = 4

$\therefore$ $P(E_1) = 4/65$

(ii) Let E_2 denotes the event that card bears a number divisible by 5. Then, numbers favourable to event E_2 are 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70.

$\therefore$ Number of favourable outcomes = 13

$\therefore \quad P(E_2) = \frac{13}{65} = \frac{1}{5}$

(iii) Let E_3 denotes the event that card bears an odd number less than 30. Then, numbers favourable to event E_3 are 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29.

$\therefore$ Number of favourable outcomes = 12

$\therefore \quad P(E_3) = \frac{12}{65}$

(iv) Let E_4 denotes the event that card bears a composite number between 50 and 70. Then, numbers favourable to event E_4 are 51, 52, 54, 55, 56, 57, 58, 60, 62, 63, 64, 65, 66, 68, 69.

$\therefore$ Number of favourable outcomes = 15

$\therefore \quad P(E_4) = \frac{15}{65} = \frac{3}{13}$

OR

Hari throws two dice once.

When a pair of different dice is thrown, then the total number of possible outcomes = 6 × 6 = 36

Let A denotes the event that the product of two numbers is 36.

$\therefore$ Favourable outcome is (6, 6) *i.e.*, 1 in number.

$\therefore$ $P(A) = 1/36$

Suresh throws one die.

So, the number of possible outcomes = 6

Let B denotes the event that the square of the number is 36.

$\therefore$ Favourable outcome is 6 *i.e.*, 1 in number.

$\therefore$ $P(B) = \frac{1}{6} = \frac{6}{36}$

Since, $P(B) > P(A)$

$\therefore$ Suresh has better chance of getting the number 36.

33. (i) Total number of balls = 18

Given, number of red balls = x

$\therefore$ $P(\text{drawing a red ball}) = \frac{x}{18}$

$\therefore$ $P(\text{not drawing a red ball}) = 1 - P(\text{drawing a red ball})$

$= 1 - \frac{x}{18} = \frac{18 - x}{18}$

(ii) When 2 more red balls are added, then total number of balls = 18 + 2 = 20 and number of red balls = $x + 2$

$\therefore$ $P(\text{drawing a red ball}) = \frac{x+2}{20}$

According to question, $\frac{x+2}{20} = \frac{9}{8}\left(\frac{x}{18}\right) \Rightarrow \frac{x+2}{20} = \frac{x}{16}$

$\Rightarrow$ $16(x + 2) = 20x$

$\Rightarrow$ $4x + 8 = 5x \Rightarrow x = 8$

OR

Let R, W and G be the event of getting red, white and green balls respectively.

Given, total number of balls = 30 and number of red balls = 15

$\therefore$ $P(R) = \frac{15}{30} = \frac{1}{2}$

Given, $P(W) = 2 \times P(G)$ ... (i)

We know, sum of probabilities of elementary events is 1.

$\therefore$ $P(R) + P(W) + P(G) = 1$

$\Rightarrow$ $\frac{1}{2} + 2P(G) + P(G) = 1$ [From (i)]

$\Rightarrow$ $3P(G) = 1 - \frac{1}{2} = \frac{1}{2} \Rightarrow P(G) = \frac{1}{6}$

From (i), $P(W) = 2 \times \frac{1}{6} = \frac{1}{3}$

$\Rightarrow$ $\frac{\text{Number of white balls}}{30} = \frac{1}{3}$

$\Rightarrow$ Number of white balls = $\frac{1}{3} \times 30 = 10$

Now, $P(G) = \frac{1}{6}$

$\Rightarrow$ $\frac{\text{Number of green balls}}{30} = \frac{1}{6}$

$\Rightarrow$ Number of green balls = $\frac{1}{6} \times 30 = 5$

Hence, number of white and green balls are respectively 10 and 5.

34. Total number of outcomes = 6 × 6 = 36

(i) Favourable outcomes when sum is even are {(1, 1), (1, 3), (1, 5), (2, 2), (2, 4), (2, 6), (3, 1), (3, 3), (3, 5), (4, 2), (4, 4), (4, 6), (5, 1), (5, 3), (5, 5), (6, 2), (6, 4), (6, 6)} *i.e.*, 18 in number.

$\therefore$ $P(\text{getting even sum}) = \frac{18}{36} = \frac{1}{2}$

(ii) Favourable outcomes when product is even are {(1, 2), (1, 4), (1, 6), (2, 1), (2, 2), (2, 3), (2, 4), (2, 5), (2, 6), (3, 2), (3, 4), (3, 6), (4, 1), (4, 2), (4, 3), (4, 4), (4, 5), (4, 6), (5, 2), (5, 4), (5, 6), (6, 1), (6, 2), (6, 3), (6, 4), (6, 5), (6, 6)} *i.e.*, 27 in number

$\therefore$ $P(\text{getting even product}) = \frac{27}{36} = \frac{3}{4}$