In this worksheet you will practise constructing and interpreting probability distribution tables and graphs for various scenarios. Work through the questions carefully. Ensure that all probability distributions you construct are valid discrete distributions with all probabilities summing to 1.

Easy Questions

1. Construct a probability distribution table for the outcomes when a fair coin is tossed once, where the outcomes are Heads and Tails. Write the outcome in one column and its corresponding probability in the adjacent column.

2. Construct a probability distribution table for the possible outcomes when a fair six-sided die is rolled. List each face (from 1 to 6) with its probability.

3. A bag contains three different coloured balls: red, blue and green, with each ball equally likely to be drawn. Construct a probability distribution table for the outcome (colour) of the draw.

4. A spinner is divided into four equal sectors labelled A, B, C and D. Construct a probability distribution table for the spinner outcomes.

5. Construct a probability distribution table for selecting a letter at random from the set A, B, C, D, assuming each letter is equally likely.

Intermediate Questions

6. A fair coin is tossed twice. Let X be the number of heads obtained. Construct a probability distribution table for X.

7. A jar contains five marbles numbered from 1 to 5, each drawn with equal probability. Construct a probability distribution table for X, where X is the number on the marble drawn.

8. Consider drawing a card at random from a set of ten uniquely numbered cards (from 1 to 10). Construct a probability distribution table for X, where X is the number on the card drawn.

9. In a raffle, a ticket is drawn at random from a bowl containing seven tickets numbered uniquely. Construct a probability distribution table for X, where X is the drawn ticket number.

10. An experiment consists of rolling a fair four-sided die twice. Let X be the sum of the two outcomes. Construct a probability distribution table for X. (Hint: Identify all possible sums and their frequencies; there are 16 equally likely outcomes.)

11. A spinner is divided into six equal parts labelled 2, 4, 6, 8, 10 and 12. Construct a probability distribution table for the spinner outcomes.

12. In a bag there are 2 red, 3 blue and 5 green marbles. Let X be the number of letters in the colour name of the marble drawn (assume red has 3 letters, blue 4, green 5). Construct a probability distribution table for X.

13. A bag contains three coins: one is double-headed, one is double-tailed, and one is a standard fair coin. One coin is selected at random and flipped. Let X be the number of heads obtained. Construct a probability distribution table for X.

14. The table below shows the frequency of students scoring on a quiz out of 10: Score 2 appears 3 times, score 4 appears 5 times, and score 7 appears 2 times. Construct a probability distribution table for X, the score obtained, by computing the relative frequencies.

15. In a game, a ball is drawn from a bag containing 3 red balls and 2 blue balls. Let X be the number of red balls drawn (either 0 or 1, since only one ball is drawn). Construct a probability distribution table for X.

16. A spinner with eight equal sectors is labelled with the first eight prime numbers: 2, 3, 5, 7, 11, 13, 17 and 19. Construct a probability distribution table for the outcomes.

17. An urn contains four balls numbered from 1 to 4. Two balls are drawn without replacement. Let X be the sum of the numbers drawn. Construct a probability distribution table for X. (Hint: List all possible pairs and their sums.)

18. In a lottery, a participant chooses a number from 1 to 5. Then one number is drawn at random (with equal probability from 1 to 5). Let X equal 1 if the participant's number matches the drawn number, and 0 otherwise. Construct a probability distribution table for X.

19. A factory produces gadgets with 90% being defect-free and 10% defective. One gadget is selected at random. Let X be defined as 1 if the gadget is defective and 0 otherwise. Construct a probability distribution table for X.

20. A bag contains tickets with numbers such that there is one ticket each for 1 and 2, and two tickets for 3. A ticket is drawn at random. Construct a probability distribution table for X, where X is the number on the ticket drawn.

Hard Questions

21. A fair coin is tossed three times. Let X be the number of heads observed. Construct a probability distribution table for X. (Hint: There are 8 equally likely outcomes.)

22. An experiment involves drawing a card from a set of four cards numbered 1, 2, 3 and 4, but the probabilities are not equal: $P(1) = 0.1$, $P(2) = 0.2$, $P(3) = 0.3$ and $P(4) = 0.4$. Construct the probability distribution table for X, the number on the card drawn.

23. A lottery involves drawing one ball from a bag containing 10 balls numbered from 1 to 10. However, the ball numbered 7 is twice as likely to be drawn as any other ball. Construct a probability distribution table for X, where X is the ball number drawn. (Hint: Let the common probability be p for the other balls.)

24. A spinner is divided into four sectors with central angles $45°$, $90°$, $135°$ and $90°$. Construct a probability distribution table for the outcomes, where the probability of landing on a sector is proportional to its central angle. (Hint: Total angle is $360°$.)

25. A fair six-sided die is rolled twice. Let X be the absolute difference between the two numbers. Construct a probability distribution table for X. (Hint: Identify the possible values of X (from 0 to 5) and compute the number of outcomes for each value, out of 36 total outcomes.)

26. A survey is conducted with 100 participants answering a yes or no question. The responses are 60 yes and 40 no. Let X be an indicator variable where $X = 1$ for yes and $X = 0$ for no. Construct a probability distribution table for X using the relative frequencies.

27. A bag contains 2 red, 2 blue and 6 green balls. Let X be the number of letters in the colour name (red has 3 letters, blue 4, green 5). Construct a probability distribution table for X.

28. A spinner is divided into 10 sectors with central angles proportional to the first 10 natural numbers. The sector corresponding to number n has an angle proportional to n. Construct a probability distribution table for X, where X is the number on the sector. (Hint: The total sum of the proportions is $1 + 2 + \cdots + 10 = 55$.)

29. A game involves drawing two balls sequentially with replacement from a bag containing balls numbered 1, 2 and 3. Let X be the product of the two numbers drawn. Construct a probability distribution table for X. (Hint: List all 9 possible pairs and determine the frequencies of each product.)

30. Consider an experiment where a fair coin is flipped and a fair six-sided die is rolled. Let X be defined as follows: if the coin shows heads, X is the number shown on the die; if the coin shows tails, $X = 0$. Construct a probability distribution table for X.