Case Study 1

Case Study Scenario:

The students of Grade 7 have organized a special "Luck-Dip" stall for the Annual School Fair to raise funds for the local animal shelter. In this experiment, they have a large opaque fabric bag containing different colored wooden tokens. The bag contains 15 red tokens, 10 blue tokens, 8 green tokens, and 7 yellow tokens. All tokens are identical in shape and size, ensuring that each draw is fair and based purely on chance.

To play the game, a participant must pay a small fee and draw one token at random without looking inside the bag. The organizers have decided on different prize tiers based on the color drawn. A red token wins a small pencil, a blue token wins a notebook, a green token wins a geometry box, and a yellow token wins the grand prize: a school bag. Before starting the game, the student in charge, Rahul, needs to calculate the theoretical probability of various events to ensure the stall remains profitable while still being exciting for the participants. He also needs to understand the sample space and the nature of mutually exclusive events occurring within this simple probability experiment.

Multiple Choice Questions

1. What is the total number of possible outcomes (size of the sample space) for a single draw from the Luck-Dip bag?

   (a) 35
   (b) 40
   (c) 30
   (d) 45

   Answer: (b) 40
   Solution: The total number of outcomes is the sum of all tokens in the bag. Total = 15(red) + 10(blue) + 8(green) + 7(yellow) = 40.

2. If a student draws a token at random, what is the probability that they win the grand prize (a school bag)?

   (a) 7/40
   (b) 1/4
   (c) 1/5
   (d) 8/40

   Answer: (a) 7/40
   Solution: The grand prize is won by drawing a yellow token. There are 7 yellow tokens. Probability $P(\text{Yellow}) = \frac{\text{Number of favorable outcomes}}{\text{Total number of outcomes}} = \frac{7}{40}$.

3. What is the probability that a participant draws either a blue token or a green token?

   (a) 10/40
   (b) 18/40
   (c) 9/20
   (d) 8/40

   Answer: (c) 9/20
   Solution: Number of blue tokens = 10. Number of green tokens = 8. Favorable outcomes = 10 + 8 = 18. Probability = 18/40. Simplifying the fraction by dividing by 2, we get 9/20.

4. A participant claims that the probability of NOT drawing a red token is higher than the probability of drawing a red token. Is this correct? What is the probability of NOT drawing red?

   (a) No, 15/40
   (b) Yes, 25/40
   (c) Yes, 15/40
   (d) No, 25/40

   Answer: (b) Yes, 25/40
   Solution: Total tokens = 40. Red tokens = 15. Tokens that are not red = $40 - 15 = 25$. $P(\text{Not Red}) = 25/40$. Since $25/40 > 15/40$, the statement is correct.

5. Which of the following best describes the "event" of drawing a purple token from this specific bag?

   (a) Likely event
   (b) Certain event
   (c) Impossible event
   (d) Unlikely event

   Answer: (c) Impossible event
   Solution: Since there are no purple tokens in the bag (the colors are only red, blue, green, and yellow), the number of favorable outcomes is 0. An event with a probability of 0 is called an impossible event.