Problem:

There are three identical boxes. There are 2 white and 2 black balls in the 1st box; there are 3 black balls in the 2nd box and 1 black and 5 white balls in the 3rd box. Someone, randomly choosing a box, takes out a random ball. What is the probability that the ball will be white?

Solution:

There are 2 white and 2 black balls in the 1st box, there are 3 black balls in the 2nd box and 1 black and 5 white balls in the 3rd box. A box is chosen randomly and a ball is taken out. Let's denote the events:

$A_1$ – the ball, taken out, is from the 1st box.

$A_2$ – the ball, taken out, is from the 2nd box.

$A_3$ – the ball, taken out, is from the 3rd box.

$A$ – the ball, taken out, is white.

Let's note that the events $A_1, A_2, A_3$ comprise a complete group of events ⇒ in accordance with the formula of total probability, we have: $P(A) = P(A_1)P(A \mid A_1) + P(A_2)P(A \mid A_2) + P(A_3)P(A \mid A_3)$. The boxes are identical ⇒ $P(A_1) = P(A_2) = P(A_3) = 1/3$, and the conditional probabilities, according to the classical definition of probability, will be:

$$P(A \mid A_1) = \frac{C_2^1}{C_4^1} = \frac{2}{4} = \frac{1}{2}, P(A \mid A_2) = 0, P(A \mid A_3) = \frac{C_5^1}{C_6^1} = \frac{5}{6} \Rightarrow$$

By the formula of total probability ⇒

$$P(A) = \frac{1}{3} \cdot \frac{1}{2} + 0 + \frac{1}{3} \cdot \frac{5}{6} = \frac{4}{9} \Rightarrow \boxed{P(A) = \frac{4}{9}}.$$

Answer: $\frac{4}{9}$.