Jar $A$ contains 3 black balls and 2 white balls. Jar $B$ contains 1 black ball and 4 white balls. Alice draws a random ball from jar $A$ and puts it in jar $B$. Bob then draws a random ball from jar $B$.

(a) What is the probability that Bob’s drawn ball is white?

**Solution:** Let $A$ and $B$ be the events that Alice and Bob draw a white ball respectively, and $A^c$, $B^c$ be the complementary events. We are given that $P(A) = 2/5$ and $P(A^c) = 3/5$, and depending of the color of the moved ball we can calculate

\[ P(B|A) = \frac{5}{6}, \quad P(B|A^c) = \frac{4}{6}. \]

By the total probability theorem,

\[ P(B) = P(A) \cdot P(B|A) + P(A^c) \cdot P(B|A^c) = \frac{2}{5} \cdot \frac{5}{6} + \frac{3}{5} \cdot \frac{4}{6} = \frac{11}{15}. \]

(b) Given the Bob drew a white ball, what is the probability that Alice moved a white ball?

**Solution:** By Bayes’ rule,

\[ P(A|B) = \frac{P(A \cap B)}{P(B)} = \frac{P(A) \cdot P(B|A)}{P(B)} = \frac{2/5 \cdot 5/6}{11/15} = \frac{5}{11}. \]