Assignment 2

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Question 10: Bag A contains 4 white balls and 3 black balls, while Bag B contains 3 white balls and 5 black balls. Two balls are drawn from Bag A and placed in Bag B. Then, what is the probability of drawing a white ball from Bag B?

Solution: Let $X = \{0, 1\}$ be a random variable representing the bags and let $Y = \{0, 1\}$ be a random variable represent the colour of the ball.

See Tables (I) and (II) for the input probabilities. The

Event	Description
$X = 0$	Ball is drawn from bag A
$X = 1$	Ball is drawn from bag B
$Y = 0$	Colour of the ball is white
$Y = 1$	Colour of the ball is black

TABLE I

Event	Probability notation/formula	Value
Both balls drawn are white from bag A	$P_1 = \Pr(Y = 0\|X = 0) \times \Pr(Y = 0\|X = 0)$	$\frac{4}{7} \times \frac{3}{6}$
Both balls drawn are white from bag A	$P_2 = \Pr(Y = 1\|X = 0) \times \Pr(Y = 1\|X = 0)$	$\frac{3}{7} \times \frac{2}{6}$
Balls drawn are white and black from bag A	$P_3 = \Pr(Y = 0\|X = 0) \times \Pr(Y = 1\|X = 0) \times 2$	$\frac{4}{7} \times \frac{3}{6} \times 2$
Ball drawn from bag B is white	$\Pr(Y = 0\|X = 1)$	?

TABLE II

desired probability is then obtained from Table (II) as

$$\Pr(Y = 0|X = 1) = P_1 \times \frac{5}{10} + P_2 \times \frac{3}{10} + P_3 \times \frac{4}{10} \tag{1}$$

$$= \frac{2}{7} \times \frac{5}{10} + \frac{1}{7} \times \frac{3}{10} + \frac{4}{7} \times \frac{4}{10} \tag{2}$$

$$= \frac{1}{7} + \frac{3}{70} + \frac{16}{70} \tag{3}$$

$$= \frac{29}{70} \tag{4}$$

Hence, the probability of drawing a white ball from bag B is $\frac{29}{70}$.