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: See Tables (I) and (II) for the input probabilities. The desired probability is then obtained from Table (II) as

Event	Description
$X_1 = 1$	First ball drawn from bag A is white
$X_1 = 0$	First ball drawn from bag A is black
$X_2 = 1$	Second ball drawn from bag A is white
$X_2 = 0$	Second ball drawn from bag A is black
$X_3 = 1$	Ball drawn from bag B is white

TABLE I

Probability	Value
$\Pr(X_1 = 1)$	$\frac{4}{7}$
$\Pr(X_1 = 0)$	$\frac{3}{7}$
$\Pr(X_2 = 1 \mid X_1 = 1)$	$\frac{3}{6}$
$\Pr(X_2 = 1 \mid X_1 = 0)$	$\frac{4}{6}$
$\Pr(X_2 = 0 \mid X_1 = 1)$	$\frac{3}{6}$
$\Pr(X_2 = 0 \mid X_1 = 0)$	$\frac{2}{6}$
$\Pr(X_3 = 1 \mid X_1 = 1, X_2 = 1)$	$\frac{5}{10}$
$\Pr(X_3 = 1 \mid X_1 = 0, X_2 = 1)$	$\frac{4}{10}$
$\Pr(X_3 = 1 \mid X_1 = 0, X_2 = 0)$	$\frac{3}{10}$
$\Pr(X_3 = 1)$	?

TABLE II

$$\Pr(X_3 = 1) = \sum_{i=0}^{1}\sum_{j=0}^{1} \Pr(X_3 = 1 \mid X_1 = i, X_2 = j) \times \Pr(X_2 = j \mid X_1 = i) \times \Pr(X_1 = i) \quad (1)$$

$$= \frac{3}{10}\times\frac{2}{6}\times\frac{3}{7} + \frac{4}{10}\times\frac{4}{6}\times\frac{3}{7} + \frac{4}{10}\times\frac{3}{6}\times\frac{4}{7} + \frac{5}{10}\times\frac{3}{6}\times\frac{4}{7} \quad (2)$$

$$= \frac{3}{70} + \frac{8}{70}\times 2 + \frac{10}{70} \quad (3)$$

$$= \frac{29}{70} \quad (4)$$

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