Question 12.13.3.18

EE22BTECH11051

Question: A box has 5 blue and 4 red balls. One ball is drawn at random and not replaced. Its colour is also not noted. Then another ball is drawn at random. What is the probability of second ball being blue?

Solution:

Let X denote the first draw random variable:

$$X = \begin{cases} 0 & \text{ball drawn is blue} \\ 1 & \text{ball drawn is red} \end{cases} \tag{1}$$

Let Y denote the second draw random variable:

$$Y = \begin{cases} 0 & \text{ball drawn is blue} \\ 1 & \text{ball drawn is red} \end{cases} \tag{2}$$

Hence the probabilities are given as:

Event	Probability
$\Pr(X = 0)$	$\frac{5}{9}$
$\Pr(X = 1)$	$\frac{4}{9}$
$\Pr(Y = 0 \mid X = 0)$	$\frac{1}{2}$
$\Pr(Y = 0 \mid X = 1)$	$\frac{5}{8}$

TABLE 1: Probabilities

Hence the required probability of the second ball beign drawn is blue is given as:

$$\Pr(Y = 0) = \Pr(X = 0)\Pr(Y = 0|X = 0) + \Pr(X = 1)\Pr(Y = 0|X = 1) \tag{3}$$

$$= \left(\frac{5}{9}\right) \times \left(\frac{1}{2}\right) + \left(\frac{4}{9}\right) \times \left(\frac{5}{8}\right) \tag{4}$$

$$= \frac{5}{9} \tag{5}$$