Assignment 2
AI1110

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***Abstract*—This document contains the solution to problem 1(ix) in 12th ICSE 2019 Paper**

Question 1(ix): Two balls are drawn from an urn containing 3 white,5 red and 2 black balls, one by one without replacement. What is the probability that at least one ball is red?

Solution:

1) Denote the outcome of experiment by a random variable $X_3 \in \{0,1\}$, where $X_3 = 0$ denote the occurrence that none of the balls drawn is red,and $X_3 = 1$ denote the occurrence that at least one ball of the balls drawn is red.
2) Let the outcome of first draw is denoted by the random variable $X_1 \in \{0,1\}$, where $X_1 = 0$ denotes the event that first ball drawn is red,and $X_1 = 1$ denotes the event that first ball drawn is not red.
3) Similarly, the outcome of second draw is denoted by the random variable $X_2 \in \{0,1\}$, where $X_2 = 1$ denotes the event that second ball drawn is red,and $X_2 = 1$ denotes the event that second ball drawn is not red. See Tables (I) and (II) for the input probabilities. The desired probability is then obtained from (1)

$$\Pr(X_3 = 1) = 1 - \Pr(X_1 = 1) \times \Pr(X_2 = 1/X_1 = 1) \tag{1}$$

$$\implies \Pr(X_3 = 1) = 1 - \frac{1}{2} \times \frac{4}{9} \tag{2}$$

$$= \frac{7}{9} \tag{3}$$

$\therefore$ The probability of drawing at least one red ball is $\frac{7}{9}$

Event	Description
$X_1 = 1$	Ball drawn in 1st draw is not red
$X_2 = 1$	Ball drawn in 2nd draw is not red
$X_3 = 1$	At least one of the balls drawn is red

TABLE I

Probability	Value
$\Pr(X_1 = 1)$	$\frac{5}{10} = \frac{1}{2}$
$\Pr(X_1 = 0)$	$\frac{1}{2}$
$\Pr(X_2 = 1 \mid X_1 = 1)$	$\frac{4}{9}$
$\Pr(X_2 = 1 \mid X_1 = 0)$	$\frac{5}{9}$
$\Pr(X_2 = 1)$	$\frac{1}{2}$
$\Pr(X_3 = 1)$	?

TABLE II