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: Let $X = \{0, 1, 2\}$ be a random variable representing the colour of the ball, and let $Y = \{0, 1\}$ be a random variable representing the draw number. Let P_7 be the probability that atleast one of the balls drawn is red. See Tables (I) and (II)

Event	Description
$X = 0$	colour of the ball drawn is Black
$X = 1$	colour of the ball drawn is White
$X = 2$	colour of the ball drawn is Red
$Y = 0$	The first draw of the balls
$Y = 1$	The second draw of the balls

TABLE I

Probability	Value
P_1= $\Pr(X = 0\|Y = 0)$	$\frac{2}{10} = \frac{1}{5}$
P_2= $\Pr(X = 1\|Y = 0)$	$\frac{3}{10}$
P_3= $\Pr(X = 0\|Y = 1) \times \Pr(X = 0\|Y = 0)$	$\frac{1}{9} \times \frac{1}{5} = \frac{1}{45}$
P_4= $\Pr(X = 0\|Y = 1) \times \Pr(X = 1\|Y = 0)$	$\frac{2}{9} \times \frac{3}{10} = \frac{1}{15}$
P_5= $\Pr(X = 1\|Y = 1) \times \Pr(X = 0\|Y = 0)$	$\frac{3}{9} \times \frac{2}{10} = \frac{1}{15}$
P_6= $\Pr(X = 1\|Y = 1) \times \Pr(X = 1\|Y = 0)$	$\frac{2}{9} \times \frac{3}{10} = \frac{1}{15}$
P_7	?

TABLE II

for the input probabilities. The desired probability is then obtained from Table (II) as

$$P_7 = 1 - (P_3 + P_4 + P_5 + P_6) \tag{1}$$
$$= 1 - (\frac{1}{45} + \frac{1}{15} + \frac{1}{15} + \frac{1}{15}) \tag{2}$$
$$= 1 - \frac{2}{9} \tag{3}$$
$$= \frac{7}{9} \tag{4}$$

Hence, the probability that atleast one of the balls drawn from the urn is red is $\frac{7}{9}$.