

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)

$$P_7 = 1 - (P_3 + P_4 + P_5 + P_6) \quad (1)$$

$$= 1 - \left(\frac{1}{45} + \frac{1}{15} + \frac{1}{15} + \frac{1}{15} \right) \quad (2)$$

$$= 1 - \frac{2}{9} \quad (3)$$

$$= \frac{7}{9} \quad (4)$$

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

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

TABLE II

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