Assignment 1

Vibhavasu Pasumarti - EP20BTECH11015

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1 PROBLEM

A bag contains 2 white and 1 red balls. One ball is drawn at random and then put back in the box after noting it's color. The process is repeated again. If X denotes the number of red balls recorded in the two draws, describe X

2 SOLUTION

Let $X \in \{0, 1, 2\}$ denote the number of red balls recorded in the two draws

$$P(X = 2) = \frac{1}{3} \times \frac{1}{3} = \frac{1}{9} \tag{1}$$

$$P(X = 1) = \left(\frac{1}{3} \times \frac{2}{3}\right) 2 = \frac{4}{9} \tag{2}$$

$$P(X = 0) = \frac{2}{3} \times \frac{2}{3} = \frac{4}{9} \tag{3}$$

X	0	1	2
P(X)	$\frac{4}{9}$	$\frac{4}{9}$	$\frac{1}{9}$

TABLE 0: Probability distribution table of X

Expectation value of X

$$\mu = E(X) = \sum x_i P(X = x_i) \tag{4}$$

$$= 0\left(\frac{4}{9}\right) + 1\left(\frac{4}{9}\right) + 2\left(\frac{1}{9}\right) \tag{5}$$

$$\tag{6}$$

$$\mu = E(X) = \frac{2}{3}$$

Variance of X:

$$\sigma(X) = \sum (x_i - \mu)^2 P(X = x_i) \tag{7}$$

$$= \left(0 - \frac{2}{3}\right)^2 \left(\frac{1}{9}\right) + \left(1 - \frac{2}{3}\right)^2 \left(\frac{4}{9}\right) + \left(2 - \frac{2}{3}\right)^2 \left(\frac{4}{9}\right) \tag{8}$$

$$\sigma(X) = \frac{8}{9}$$