Assignment 8

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***Abstract*—This document contains the solution to Example 16 of Chapter 13 (Probability) in the NCERT Class 12.**

NCERT class 12 Chapter 13(Probability)

Example 16 Bag I contains 3 red and 4 black balls while another Bag II contains 5 red and 6 black balls. One ball is drawn at random from one of the bags and it is found to be red. Find the probability that it was drawn from Bag II.

Solution:

Let's denote the random variable X_1 map to the set $\{0, 1\}$ where $X_1 = 0$ denote that the ball drawn is from Bag I and $X_1 = 1$ denote that the ball drawn is from Bag II.

Let's denote the random variable X_2 map to the set $\{0, 1\}$ where $X_2 = 0$ denote that the ball drawn is red and $X_1 = 1$ denote that the ball drawn is black. The random variables and the events they denote are listed below in the table (I)

Variable	Event
$X_1 = 0$	ball is drawn from Bag I
$X_1 = 1$	ball is drawn from Bag II
$X_2 = 0$	ball drawn is red
$X_2 = 1$	ball drawn is black

TABLE I

The required probability is $\Pr(X_1 = 1|X_2 = 0)$. Various Probability values are listed in the table (II)

Probability	Value
$\Pr(X_1 = 0)$	$\frac{1}{2}$
$\Pr(X_1 = 1)$	$\frac{1}{2}$
$\Pr(X_2 = 0\|X_1 = 0)$	$\frac{3}{7}$
$\Pr(X_2 = 0\|X_1 = 1)$	$\frac{5}{11}$
$\Pr(X_1 = 1\|X_2 = 0)$	?

TABLE II

We know that by Bayes' theorem,

$$\Pr(X_1 = 1|X_2 = 0) = \frac{\Pr(X_1 = 1)\Pr(X_2 = 0|X_1 = 1)}{\Sigma_{i=0}^{1}\Pr(X_1 = i)\Pr(X_2 = 0|X_1 = i)} \tag{1}$$

$$= \frac{\frac{1}{2} \times \frac{5}{11}}{\frac{1}{2} \times \frac{3}{7} + \frac{1}{2} \times \frac{5}{11}} \tag{2}$$

$$= \frac{35}{68} \tag{3}$$

$$\therefore \Pr(X_1 = 1|X_2 = 0) = \frac{35}{68}$$