Assignment 1
AI1110 : Probability and Random Variables

Tumarada Padmaja
CS22BTECH11059

Question:12.13.3.2: A bag contains 4 red and 4 black balls, another bag contains 2 red and 6 black balls. One of the two bags is selected at random and a ball is drawn from the bag which is found to be red. Find the probability that the ball is drawn from the first bag.

Solution:

Random Variable	Value of the random variable	Event
B	0	selecting first bag
	1	selecting second bag
R	0	choosing white ball from the bag
	1	choosing red ball from the bag

Given,

$$\Pr(R=1|B=0) = \frac{4}{8} = \frac{1}{2} \tag{1}$$

$$\Pr(R=1|B=1) = \frac{2}{8} = \frac{1}{4} \tag{2}$$

$$\Pr(B=0) = \frac{1}{2} \tag{3}$$

$$\Pr(B=1) = \frac{1}{2} \tag{4}$$

$\Pr(B=0|R=1)$= probability of choosing bag 1 given that the ball is red
From Bayer's theorem,

$$\Pr(B=0|R=1) = \frac{\Pr(R=1|B=0)\cdot\Pr(B=0)}{\Pr(R=1|B=0)\cdot\Pr(B=0)+\Pr(R=1|B=1)\cdot\Pr(B=1)} \tag{5}$$

$$= \frac{\frac{1}{2}\cdot\frac{1}{2}}{\frac{1}{2}\cdot\frac{1}{2}+\frac{1}{4}\cdot\frac{1}{2}} \tag{6}$$

$$= \frac{\frac{1}{4}}{\frac{1}{4}+\frac{1}{8}} \tag{7}$$

$$= \frac{2}{3} \tag{8}$$

Hence,

$$\Pr(B=1|R=1) = \frac{2}{3}$$

The probability that the ball is drawn from the first bag is $\frac{2}{3}$.