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:
Let B_1 be the event of selecting the first bag
B_2 be the event of selecting the second bag
R be the event of drawing a red ball
Given,

$$\Pr(R|B_1) = \frac{4}{8} = \frac{1}{2}$$

$$\Pr(R|B_2) = \frac{2}{8} = \frac{1}{4}$$

$$\Pr(R|B_1) = \frac{1}{2}$$

$$\Pr(R|B_2) = \frac{1}{2}$$

$\Pr(B_1|R)$= probability of choosing bag 1 given that the ball is red

$$\Pr(B_1|R) = \frac{\Pr(R|B_1)\,.\,\Pr(B_1)}{\Pr(R|B_1)\,.\,\Pr(B_1) + \Pr(R|B_2)\,.\,\Pr(B_2)}$$

$$= \frac{\frac{1}{2}\cdot\frac{1}{2}}{\frac{1}{2}\cdot\frac{1}{2} + \frac{1}{4}\cdot\frac{1}{2}} = \frac{\frac{1}{4}}{\frac{1}{4} + \frac{1}{8}} = \frac{2}{3} \tag{1}$$

Hence,

$$\Pr(B_1|R) = \frac{2}{3}$$

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