Assignment 2

Ajay Krishnan K
EE22BTECH11003

Question 12.13.6.16

1) Bag I contains 3 red and 4 black balls and Bag II contains 4 red and 5 black balls. One ball is transferred from Bag I to Bag II and then a ball is drawn from Bag II. The ball so drawn is found to be red in colour. Find the probability that the transferred ball is black.

Solution:

Random Variable	Value of Random Variable	Event
X	0	Ball is Red
	1	Ball is black
Y	0	Ball drawn from bag I
	1	Ball drawn from bag II

TABLE I: Random Variable Distribution

Assuming ball is not transferred,

$$P(X=0,Y=0)=\frac{3}{7} \tag{1}$$

$$P(X=1,Y=0)=\frac{4}{7} \tag{2}$$

When the ball being transferred is red,

$$P\left(X=0,Y=1|X=0\right)=\frac{5}{10} \tag{3}$$

$$=\frac{1}{2} \tag{4}$$

When the ball being transferred is black,

$$P\left(X=0,Y=1|X=1\right)=\frac{4}{10} \tag{5}$$

$$=\frac{2}{5} \tag{6}$$

Now the probability of the transferred ball is black given drawn ball being red is
(According to Bayes' theorem)

$$P\left(X=1|X=0,Y=1\right)=\frac{P\left(X=0\right)P\left(X=0,Y=1|X=0\right)}{P\left(X=0\right)P\left(X=0,Y=1|X=0\right)+P\left(X=1\right)P\left(X=0,Y=1|X=1\right)} \tag{7}$$

$$=\frac{\frac{4}{7}\times\frac{2}{5}}{\frac{3}{7}\times\frac{1}{2}+\frac{4}{7}\times\frac{2}{5}} \tag{8}$$

$$=\frac{16}{31} \tag{9}$$