

# Assignment 2

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## 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:

Initially,

Bags	Red Balls	Black Balls
Bag I	3	4
Bag II	4	5

TABLE I  
INITIAL DISTRIBUTION OF BALLS

Assuming black ball is transferred from Bag I to Bag II, Finally

Bags	Red Balls	Black Balls
Bag I	3	4
Bag II	4	5

TABLE II  
FINAL DISTRIBUTION OF BALLS

Define the variables

$E_1$  : a red ball is transferred from bag I to bag II.

$X$  : a red ball is drawn from bag II

Thus,

$$E_1 = \begin{cases} 0, & \text{Red ball is transferred} \\ 1, & \text{Black ball is transferred} \end{cases} \quad (1)$$

$$X = \begin{cases} 0, & \text{a red ball is drawn from bag II} \\ 1, & \text{a black ball is drawn from bag II} \end{cases} \quad (2)$$

Thus,

$$P(E = 0) = \frac{3}{7} \quad (3)$$

$$P(E = 1) = \frac{4}{7} \quad (4)$$

Probability that the drawn ball is red,

When the ball being transferred is red,

$$P(X = 0|E = 0) = \frac{5}{10} \quad (5)$$

$$= \frac{1}{2} \quad (6)$$

When the ball being transferred is black,

$$P(X = 0|E = 1) = \frac{4}{10} \quad (7)$$

$$= \frac{2}{5} \quad (8)$$

Now the probability of drawn ball being red given the transferred ball is black is

(According to Bayes' theorem)

$$P(E = 0|X = 1)$$

$$= \frac{P(E = 0) P(X = 1|E = 0)}{P(E = 1) P(X = 1|E = 1) + P(E = 0) P(X = 1|E = 0)} \quad (9)$$

$$= \frac{\frac{4}{7} \times \frac{2}{5}}{\frac{3}{7} \times \frac{1}{2} + \frac{4}{7} \times \frac{2}{5}} \quad (10)$$

$$= \frac{16}{31} \quad (11)$$