

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, For Bag I,

$$\text{Number of red balls} = 3 \quad (1)$$

$$\text{Number of black balls} = 4 \quad (2)$$

For Bag II,

$$\text{Number of red balls} = 4 \quad (3)$$

$$\text{Number of black balls} = 5 \quad (4)$$

Let E_1 be the event that a red ball is transferred from bag I to bag II and let E_2 be the event that a black ball is transferred from bag I to bag II.

Thus,

$$P(E_1) = \frac{3}{7} \quad (5)$$

$$P(E_2) = \frac{4}{7} \quad (6)$$

Now, let X be the event that the drawn ball is red

Probability that the drawn ball is red,

When the ball being transferred is red,

$$P(X|E_1) = \frac{5}{10} \quad (7)$$

$$= \frac{1}{2} \quad (8)$$

When the ball being transferred is black,

$$P(X|E_2) = \frac{4}{10} \quad (9)$$

$$= \frac{2}{5} \quad (10)$$

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

(According to Bayes' theorem)

$$P(E_2|X) = \frac{P(E_2)P(X|E_2)}{P(E_1)P(X|E_1) + P(E_2)P(X|E_2)} \quad (11)$$

$$= \frac{\frac{4}{7} \times \frac{2}{5}}{\frac{3}{7} \times \frac{1}{2} + \frac{4}{7} \times \frac{2}{5}} \quad (12)$$

$$= \frac{16}{31} \quad (13)$$