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:

Random Variable	Value of Random Variable	Event
E	0	Red ball is transferred
	1	Black ball is transferred
X	0	Red ball is drawn from bag II
	1	Black ball is drawn from bag II

TABLE I: Random Variable Distribution

Thus,

$$P(E = 0) = \frac{3}{7} \tag{1}$$

$$P(E = 1) = \frac{4}{7} \tag{2}$$

Probability that the drawn ball is red,
When the ball being transferred is red,

$$P(X = 0|E = 0) = \frac{5}{10} \tag{3}$$

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

When the ball being transferred is black,

$$P(X = 0|E = 1) = \frac{4}{10} \tag{5}$$

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

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

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

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

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