AI1110 Assignment 2 in LaTeX

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12.13.6.16: Bag I contains 3 red balls and 4 black balls and Bag II contains 4 red and 5 black balls. One ball is transfered 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 transfered ball is black.
Solution:

(a) Let the random variables be

TABLE (a)
RANDOM VARIABLES AND THEIR DISTRIBUTION

Random variable	Description	Values
X	Colour of ball drawn from Bag	0 for red,1 for black
Y	Bag number from which ball is drawn	0 for red,1 for black

From given information

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

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

After ball is tranferred from bag I to bag II

$$\Pr(X=0,Y=1)=\Pr(X=0,Y=0)\times\frac{5}{10}+\Pr(X=1,Y=0)\times\frac{4}{10} \tag{3}$$

As X and Y are independent,

$$\Pr(X=0,Y=1)=\frac{3}{7}\times\frac{5}{10}+\frac{4}{7}\times\frac{4}{10} \tag{4}$$

$$\implies =\frac{31}{70} \tag{5}$$

TABLE (a)
EVENT AND PROBABILITY TABLE

Event	Probability
$X=0,Y=0$	3/7
$X=1,Y=0$	4/7
$X=0,Y=1$	31/70

(b) Required probability is

$$\Pr(X=1,Y=0|X=0,Y=1)=\frac{\Pr(X=0,Y=1|X=1,Y=0)\Pr(X=1,Y=0)}{\Pr(X=0,Y=1)} \tag{6}$$

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Equation (6) gives the drawn ball from bag I is black given ball drawn from bag II is red. Substituting these values in equation number (6),

$$\Pr(X = 1, Y = 0 | X = 0, Y = 1) = \frac{\frac{4}{10} \times \frac{4}{7}}{\frac{31}{70}} \tag{7}$$

$$\implies = \frac{\frac{16}{70}}{\frac{31}{70}} \tag{8}$$

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

$\therefore$ The probability that the transferred ball is black given that the drawn ball is red is $\frac{16}{31}$.