

Assignment

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An urn contains m white and n black balls. A ball is drawn at random and is put back into the urn along with k additional balls of the same colour as that of the ball drawn. A ball is again drawn at random. Show that the probability of drawing a white ball now does not depend on k .

Solution:

parameters	values	decription
X	0	first ball
	1	second ball
Y	0	black ball
	1	white ball

TABLE 1: Random variable description

Using total probability theorem,the desired probability is

$$= p_{XY}(00) \Pr(X = 1, Y = 1 | X = 0, Y = 0) + p_{XY}(01) \Pr(X = 1, Y = 1 | X = 0, Y = 1) \quad (1)$$

$$= \left(\frac{n}{m+n} \right) \left(\frac{m}{m+n+k} \right) + \left(\frac{m}{m+n} \right) \left(\frac{m+k}{m+n+k} \right) \quad (2)$$

$$= \frac{mn + m(m+k)}{(m+n)(m+n+k)} \quad (3)$$

$$= \frac{m(m+n+k)}{(m+n)(m+n+k)} \quad (4)$$

$$= \frac{m}{m+n} \quad (5)$$

which is independent of k .