Probability Assignment 1

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1 Problem statement

Two balls are drawn at random with replacement from box containing 10 black and 8 red balls. Find the probability that :

1) both balls are red
2) one of them is black and the other one is red

2 Answer

Defining random variable X_j such that:

1) X_j: Colour of j^{th} ball picked

$$X_j = \begin{cases} 1, & \text{Red ball} \\ 0, & \text{Black ball} \end{cases} \tag{1}$$

For picking two balls, j = 1, 2
Let us define, X = X_1 + X_2

$$X = \begin{cases} 0, & \text{none are red} \\ 1, & \text{one of them red} \\ 2, & \text{both red} \end{cases} \tag{2}$$

$$X \sim Bin(n, p) \tag{3}$$

$$p = \frac{4}{9} \tag{4}$$

$$n = 2 \tag{5}$$

2) Both balls are red :

$$\Pr(X = 2) = {}^2C_2 \left(\frac{4}{9}\right)^2 \left(\frac{5}{9}\right)^0 \tag{6}$$

$$= \frac{16}{81} \tag{7}$$

3) One of them is black and other is red :

$$\Pr(X = 1) = {}^2C_1 \left(\frac{4}{9}\right)^1 \left(\frac{5}{9}\right)^1 \tag{8}$$

$$= \frac{40}{81} \tag{9}$$