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) first ball is black and second ball is red
3) one of them is black the other one is red

2 Answer

Assume random variable X and Y:

- X_1: Colour of first ball picked

$$X_1 = \begin{cases} 1, & \text{for red ball} \\ 0, & \text{for black ball} \end{cases}$$

- X_2: Colour of second ball picked

$$X_2 = \begin{cases} 1, & \text{for red ball} \\ 0, & \text{for black ball} \end{cases}$$

- Both balls are red :

$$= \Pr(X_1 = 1, X_2 = 1) \tag{1}$$
$$= \left(\frac{^8C_1}{^{18}C_1}\right) \times \left(\frac{^8C_1}{^{18}C_1}\right) \tag{2}$$
$$= \frac{16}{81} \tag{3}$$

- First ball is black and second is red :

$$= \Pr(X_1 = 0, X_2 = 1) \tag{4}$$
$$= \left(\frac{^{10}C_1}{^{18}C_1}\right) \times \left(\frac{^8C_1}{^{18}C_1}\right) \tag{5}$$
$$= \frac{20}{81} \tag{6}$$

- One of them is black and other is red :

$$= \Pr(X_1 = 1, X_2 = 0) + \Pr(X_1 = 0, X_2 = 1) \tag{7}$$
$$= \left(\frac{^8C_1}{^{18}C_1}\right) \times \left(\frac{^{10}C_1}{^{18}C_1}\right) + \left(\frac{^{10}C_1}{^{18}C_1}\right) \times \left(\frac{^8C_1}{^{18}C_1}\right) \tag{8}$$
$$= \frac{40}{81} \tag{9}$$