EE22BTECH11029 - Komakula Sreeja

Question 11.16.3.20

While shuffling a pack of 52 playing cards, 2 cards are dropped. Find the probabilty that the missing cards to be of different colours.

Solution: We know that the 52 playing cards contain 26 red cards and 26 black cards.

Let X be a random variable denoting the colour of first card:

$$X = \begin{cases} 0, & \text{red card} \\ 1, & \text{black card} \end{cases} \tag{1}$$

Probability of choosing the first card:

$$p_X(k) = \frac{26}{52} \quad \{k = 0, 1\} \tag{2}$$

$$= \frac{1}{2} \tag{3}$$

Let Y be a random variable denoting the colour of second card:

$$Y = \begin{cases} 0, & \text{red card} \\ 1, & \text{black card} \end{cases} \tag{4}$$

Probability of choosing the second card after the first card is already choosen if:
Second card has same colour as the first card:

$$p_Y(k) = \frac{25}{51} \quad \{k = 0, 1\} \tag{5}$$

Second card has different colour from the first card:

$$p_Y(k) = \frac{26}{51} \quad \{k = 0, 1\} \tag{6}$$

Probabilty that both cards have different colour:

$$p(\text{different colours}) = p(\text{X=0 and Y=1}) + p(\text{X=1 and Y=0}) \tag{7}$$

$$= \left(\frac{26}{52}\right)\left(\frac{26}{51}\right) + \left(\frac{26}{52}\right)\left(\frac{26}{51}\right) \tag{8}$$

$$= 2\left(\frac{1}{2}\right)\left(\frac{26}{51}\right) \tag{9}$$

$$= \frac{26}{51} \tag{10}$$

TABLE 1: Description of random variables

Random Variable	Values	Description
X	0	First card is red
	1	First card is black
Y	0	Second card is red
	1	Second card is black