Assignment 6

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***Abstract*—This document contains the solution to Problem 2 of Exercise 13.2 of Chapter 13 (Probability) in the NCERT Class 12.**

NCERT class 12 Chapter 13(Probability) Exercise 13.2 Problem 2

Two cards are drawn at random and without replacement from a pack of 52 cards. Find the probability that both the cards are black.

Solution:

Let's denote the random variable X_1 map to the set $\{0, 1\}$ where $X_1 = 0$ denote that the first card drawn is red and $X_1 = 1$ denote that the first card drawn is black.

Let's denote the random variable X_2 map to the set $\{0, 1\}$ where $X_2 = 0$ denote that the second card drawn is red and $X_2 = 1$ denote that the second card drawn is black.

The random variables and the events they denote are listed below in the table (I)

Variable	Event
$X_1 = 0$	1^{st} card is red
$X_1 = 1$	1^{st} card is black
$X_2 = 0$	2^{nd} card is red
$X_2 = 1$	2^{nd} card is black

TABLE I

The required probability is $\Pr(X_1 = 1, X_2 = 1)$. Various Probability values are given in the table (II)

Probability	Value
$\Pr(X_1 = 1)$	$\frac{1}{2}$
$\Pr(X_2 = 1 \mid X_1 = 1)$	$\frac{25}{51}$
$\Pr(X_2 = 1, X_1 = 1)$	?

TABLE II

We know that, by multiplication rule,

$$\Pr(X_2 = 1, X_1 = 1) = \Pr(X_1 = 1) \times \Pr(X_2 = 1 \mid X_1 = 1) \quad (1)$$

$$\implies \Pr(X_2 = 1, X_1 = 1) = \frac{1}{2} \times \frac{25}{51} \quad (2)$$

$$\implies \Pr(X_2 = 1, X_1 = 1) = \frac{25}{102} \quad (3)$$