Assignment 2

AI1110: Probability and Random Variables

INDIAN INSTITUTE OF TECHNOLOGY, HYDERABAD

Ladva Umanshiva
AI22BTECH11016

11.16.3.4: A card is selected from a pack of 52 cards.

(a) How many points are there in the sample space?
(b) Calculate the probability that the card is an ace of spades.
(c) Calculate the probability that the card is
   i) an ace
   ii) black card

Solution: Let $n(A)$ denote the number of possible outcomes for any event A.

(a) Let S be the sample space
Clearly, the number of possible outcomes are 52 as there are 52 cards.
$\therefore$ There are 52 points in sample space.

$$\therefore n(S) = 52 \tag{1}$$

Event	Description
E	Selected card is an ace of spades.
A	Selected card is an ace.
B	Selected card is a black card.

TABLE (a)
EVENT DECLARATION

(b) Clearly,

$$n(E) = 1 \tag{2}$$

Let X be a random variable such that,

$$X = \begin{cases} 1, & \text{if the selected card is an ace of spades} \\ 0, & \text{otherwise} \end{cases} \tag{3}$$

$$\therefore \Pr(X = 1) = \frac{n(E)}{n(S)} = \frac{1}{52} \tag{4}$$

$$\therefore \Pr(X = 1) = \frac{1}{52} \tag{5}$$

(c) i) There are 4 aces in a deck of 52 cards.

$$\therefore n(A) = 4 \tag{6}$$

Let Y be a random variable such that,

$$Y = \begin{cases} 1, & \text{if the selected card is an ace} \\ 0, & \text{otherwise} \end{cases} \tag{7}$$

$$\therefore \Pr(Y = 1) = \frac{n(A)}{n(S)} = \frac{4}{52} = \frac{1}{13} \tag{8}$$

$$\therefore \Pr(Y = 1) = \frac{1}{13} \tag{9}$$

ii) There are 26 black card in a deck of 52 cards.

$$\therefore n(B) = 26 \tag{10}$$

Let Z be a random variable such that,

$$Z = \begin{cases} 1, & \text{if the selected card is a black card} \\ 0, & \text{otherwise} \end{cases} \tag{11}$$

$$\therefore \Pr(Z = 1) = \frac{n(B)}{n(S)} = \frac{26}{52} = \frac{1}{2} \tag{12}$$

$$\therefore \Pr(Z = 1) = \frac{1}{2} \tag{13}$$