Assignment 3

AI1110: Probability and Random Variables
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Question 10.15.1.14 : One card is drawn from a well-shuffled deck of 52 cards. Find the probability of getting

1) a king of red colour
2) a face card
3) a red face card
4) the jack of hearts
5) a spade
6) the queen of diamonds

Solution:

VARIABLE	RANGE	DESCRIPTION
X	{0,1}	The Random variable denoting the Color of the card.
Y	{0,1,2,3}	The Random variable denoting the Type of the card.
Z	{0,1,2,3,4,5,6,7,8,9,10,11,12}	The Random variable denoting the Value of the card.

TABLE 1

$$\text{Total number of cards } = 52 \tag{1}$$

$$n(S) = 52 \tag{2}$$

$$\Pr(E) = \frac{n(E)}{n(S)} \tag{3}$$

a) Total number of kings of red colour = 2

$$\Pr(\text{A King of Red colour}) = \Pr((X = 1), (Z = 12)) \tag{4}$$

$$= (\Pr(X = 1))(\Pr(Z = 12)) \tag{5}$$

$$= \frac{(n(X = 1))(n(Z = 12))}{n(S)} \tag{6}$$

$$\Pr((X=1),(Z=12)) = \frac{2}{52} = 0.038 \tag{7}$$

$$\therefore \Pr((X=1),(Z=12)) = 0.038 \tag{8}$$

b) Number of cards that are face cards = 12

$$\Pr(\text{A Face card}) = \Pr((Z=12)+(Z=11)+(Z=10)+(Z=1)) \tag{9}$$

$$= \frac{n(Z=12)+n(Z=11)+n(Z=10)+n(Z=1)}{n(S)} \tag{10}$$

$$= \frac{12}{52} = 0.23 \tag{11}$$

$$\therefore \Pr((Z=12)+(Z=11)+(Z=10)+(Z=1)) = 0.23 \tag{12}$$

c) Number of cards that are red face cards = 6

$$\Pr(\text{A Red Face card}) = \Pr((X=1),((Z=12)+(Z=11)+(Z=10)+(Z=1))) \tag{13}$$

$$\Pr(\text{A Red Face card}) = (\Pr(X=1))(\Pr((Z=12)+(Z=11)+(Z=10)+(Z=1))) \tag{14}$$

$$= \frac{(n(X=1))(n((Z=12)+(Z=11)+(Z=10)+(Z=1))}{n(S)} \tag{15}$$

$$= \frac{6}{52} = 0.11 \tag{16}$$

$$\therefore \Pr((X=1),((Z=12)+(Z=11)+(Z=10)+(Z=1))) = 0.11 \tag{17}$$

d) Number of cards that are jack of hearts = 1

$$\Pr(\text{The Jack of Hearts}) = \Pr((Z=10),(Y=2)) \tag{18}$$

$$\Pr((Z=10),(Y=2)) = (\Pr(Z=10))(\Pr(Y=2)) \tag{19}$$

$$= \frac{(n(Z=10))(n(Y=2))}{n(S)} \tag{20}$$

$$= \frac{1}{52} = 0.019 \tag{21}$$

$$\therefore \Pr((Z=10),(Y=2)) = 0.019 \tag{22}$$

e) Number of cards that are spade = 13

$$\Pr(\text{A Spade}) = \Pr(Y=1) \tag{23}$$

$$= \frac{n(Y=1)}{n(S)} \tag{24}$$

$$= \frac{13}{52} = 0.25 \tag{25}$$

$$\therefore \Pr(Y=1) = 0.25 \tag{26}$$

f) Number of cards that are queens of diamonds = 1

$$\Pr(\text{The Queen of Diamonds}) = \Pr((Z=11),(Y=3)) \tag{27}$$

$$\Pr((Z=11),(Y=3)) = (\Pr(Z=11))(\Pr(Y=3)) \tag{28}$$

$$= \frac{(n(Z=11))(n(Y=3))}{n(S)} \tag{29}$$

$$= \frac{1}{52} = 0.019 \tag{30}$$

$$\therefore \Pr((Z=11),(Y=3)) = 0.019 \tag{31}$$