

# Assignment 3

**AI1110: Probability and Random Variables**  
Indian Institute of Technology Hyderabad

Sudarshan Shivashankar  
AI22BTECH11027

**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

Total number of cards = 52

$$n(S) = 52 \quad (1)$$

$$\Pr(E) = \frac{n(E)}{n(S)} \quad (2)$$

$$\text{For } X=\{0,1\}, \Pr(X) = \frac{n(X)}{n(S)} = \frac{26}{52} = \frac{1}{2} \quad (3)$$

$$\text{For } Y=\{0,1,2,3\}, \Pr(Y) = \frac{n(Y)}{n(S)} = \frac{13}{52} = \frac{1}{4} \quad (4)$$

$$\text{For } Z=\{0,1\}, \Pr(X) = \frac{n(Z)}{n(S)} = \frac{4}{52} = \frac{1}{13} \quad (5)$$

a) Total number of kings of red colour = 2

PROBABILITY	RANGE OF RANDOM VARIABLE	VALUE OF PROBABILITY
$\Pr(X)$	$\{0,1\}$	$\frac{1}{2}$
$\Pr(Y)$	$\{0,1,2,3\}$	$\frac{1}{4}$
$\Pr(Z)$	$\{0,1,2,3,4,5,6,7,8,9,10,11,12\}$	$\frac{1}{13}$

TABLE 2

$$\Pr(\text{A King of Red colour}) = \Pr((X = 1), (Z = 12)) \quad (6)$$

$$= (\Pr(X = 1))(\Pr(Z = 12)) \quad (7)$$

$$\Pr((X = 1), (Z = 12)) = \frac{1}{2} \times \frac{1}{13} \quad (8)$$

$$= \frac{1}{26} = 0.038 \quad (9)$$

$$\therefore \Pr((X = 1), (Z = 12)) = 0.038 \quad (10)$$

b) Number of cards that are face cards = 12

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

$$= \frac{4}{13} = 0.23 \quad (12)$$

$$\therefore \Pr((Z=12)+(Z=11)+(Z=10)+(Z=9)) = 0.23 \quad (13)$$

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

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

$$\Pr(\text{A Red Face card}) = (\Pr(X=1))(\Pr((Z=12)+(Z=11)+(Z=10))) \quad (15)$$

$$= \frac{1}{2} \times \frac{3}{13} \quad (16)$$

$$= \frac{3}{26} = 0.11 \quad (17)$$

$$\therefore \Pr((X=1), ((Z=12)+(Z=11)+(Z=10))) = 0.11 \quad (18)$$

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

$$\Pr(\text{The Jack of Hearts}) = \Pr((Z=10), (Y=2)) \quad (19)$$

$$\Pr((Z=10), (Y=2)) = (\Pr(Z = 10))(\Pr(Y = 2)) \quad (20)$$

$$= \frac{1}{13} \times \frac{1}{4} \quad (21)$$

$$= \frac{1}{52} = 0.019 \quad (22)$$

$$\therefore \Pr((Z=10), (Y=2)) = 0.019 \quad (23)$$

e) Number of cards that are spade = 13

$$\Pr(\text{A Spade}) = \Pr(Y=1) \quad (24)$$

$$= \frac{1}{4} = 0.25 \quad (25)$$

$$\therefore \Pr(Y=1) = 0.25 \quad (26)$$

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

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

$$\Pr((Z=11), (Y=3)) = (\Pr(Z = 11))(\Pr(Y = 3)) \quad (28)$$

$$= \frac{1}{13} \times \frac{1}{4} \quad (29)$$

$$= \frac{1}{52} = 0.019 \quad (30)$$

$$\therefore \Pr((Z=11), (Y=3)) = 0.019 \quad (31)$$