CBSE Class–12 Mathematics

NCERT solution

Chapter - 13

Probability - Exercise 13.4

1. State which of the following are not the probability distributions of a random variable. Give reasons for your answer.

(i)

X	0	1	2
P (X)	0.4	0.4	0.2

(ii)

X	0	1	2	3	4
P (X)	0.1	0.5	0.2	– 0.1	0.3

(iii)

Y	– 1	0	1
P (Y)	0.6	0.1	0.2

(iv)

Z	3	2	1	0	– 1
P (Z)	0.3	0.2	0.4	0.1	0.05

Ans. (i) $P(0) + P(1) + P(2) = 0.4 + 0.4 + 0.2 = 1$

Therefore, it is a probability distribution of a random variable.

(ii) $P(3) = -0.1$ which is not possible.

Therefore, it is not a probability distribution.

(iii) $P(-1) + P(0) + P(1) = 0.6 + 0.1 + 0.2 = 0.9 \neq 1$

Therefore, it is not a probability distribution.

(iv) P (3) + P (2) + P (1) + P (0) + P (–1) = 0.3 + 0.2 + 0.4 + 0.1 + 0.05 = 1.05 $\neq$ 1

Therefore, it is not a probability distribution.

2. An urn contains 5 red and 2 black balls. Two balls are randomly selected. Let X represents the number of black balls. What are the possible values of X? Is X a random variable?

Ans. There two balls may be selected as BR, RB, BR, BB, where R represents red ball and B represents black ball.

Variable X has the value 0, 1, 2, i.e., there may be no black ball, may be one black ball or both the balls are black.

Since, X is a number whose values are defined on the outcomes of a random experiment, therefore, X is a random variable.

3. Let X represents the difference between the number of heads and the number of tails obtained when a coin is tossed 6 times. What are possible values of X?

Ans. Let h denotes the number of heads and t denotes the number of tails, when a coin is tossed 6 times. Then,

X = difference between h and t = $|h-t|$

Now,	h : 0	1	2	3	4	5	6
Therefore,	t : 6	5	4	3	2	1	0
And, hence	X : 6	4	2	0	2	4	6

Therefore, the possible values of X are 6, 4, 2, 0.

4. Find the probability distribution of:

(i) Number of heads in two tosses of a coin.

(ii) Number of tails in the simultaneous tosses of three coins.

(iii) Number of heads in four tosses of a coin.

Ans. (i) The sample space of the random experiment 'a coin is tossed twice' is S = {HH, HT, TH, TT} $\Rightarrow n(S)$ = 4

Let X denotes the random variable 'number of heads', then A can take the values 0, 1 or 2.

P (X = 0) = $P(\overline{A})P(\overline{A})$ = $\frac{1}{2}\times\frac{1}{2}=\frac{1}{4}$

P (X = 1) = 2 P (A) $P(\overline{A})$ = $2\times\frac{1}{2}\times\frac{1}{2}=\frac{2}{4}$ = $\frac{1}{2}$

P (X = 2) = P (A). P (A) = $\frac{1}{2}\times\frac{1}{2}=\frac{1}{4}$

Probability distribution

X_i	0	1	2
P_i	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{1}{4}$

(ii) Three coins tossed once = one coin tossed three times

$\therefore$ S = {(HHH, HHT, HTH, THH, HTT, THT, TTH, TTT} $\Rightarrow n(S)$ = 8

Let X denotes the random variable 'number of heads', then A can take the values 0, 1, 2 or 3.

P (X = 0) = $P(\overline{A})P(\overline{A})P(A)$ = $\frac{1}{2}\times\frac{1}{2}\times\frac{1}{2}=\frac{1}{8}$

P (X = 1) = 3 P (A) $P(\overline{A})P(\overline{A})$ = $3\times\frac{1}{2}\times\frac{1}{2}\times\frac{1}{2}=\frac{3}{8}$

P (X = 2) = 3 P (A). P (A). $P(\overline{A})$ = $3\times\frac{1}{2}\times\frac{1}{2}\times\frac{1}{2}=\frac{3}{8}$

P (X = 3) = P (A). P (A). P (A) = $\frac{1}{2}\times\frac{1}{2}\times\frac{1}{2}=\frac{1}{8}$

Probability distribution

X_i	0	1	2	3
P_i	$\frac{1}{8}$	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{1}{8}$

(iii) A coin is tossed four times = S = {HHHH, HHHT, HHTH, HTHH, THHH, HHTT, HTHT, HTTH, THHT, THTH, TTHH, HTTT, THTT, TTHT, TTTH, TTTT}$\Rightarrow n(S)$ = 16

Let X denotes the random variable 'number of heads', then A can take the values 0, 1, 2, 3 or 4.

P (X = 0) = $P(\overline{A})P(\overline{A})P(\overline{A})P(\overline{A})$ = $\frac{1}{2}\times\frac{1}{2}\times\frac{1}{2}\times\frac{1}{2}=\frac{1}{16}$

P (X = 1) = 4 P (A) $P(\overline{A})P(\overline{A})P(\overline{A})$ = $4\times\frac{1}{2}\times\frac{1}{2}\times\frac{1}{2}\times\frac{1}{2}=\frac{4}{16}$ = $\frac{1}{4}$

P (X = 2) = 6 P (A). P (A). $P(\overline{A})P(\overline{A})$ = $6\times\frac{1}{2}\times\frac{1}{2}\times\frac{1}{2}\times\frac{1}{2}=\frac{6}{16}$ = $\frac{3}{8}$

P (X = 3) = 4 P (A). P (A). P (A). $P(\overline{A})$ = $4\times\frac{1}{2}\times\frac{1}{2}\times\frac{1}{2}\times\frac{1}{2}=\frac{4}{16}$ = $\frac{1}{4}$

P (X = 4) = P (A). P (A). P (A). P (A) = $\frac{1}{2}\times\frac{1}{2}\times\frac{1}{2}\times\frac{1}{2}=\frac{1}{16}$

Probability distribution

X_i	0	1	2	3	4
P_i	$\frac{1}{16}$	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{4}$	$\frac{1}{16}$

5. Find the probability distribution of the number of success in two tosses of a die where a success is defined as:

(i) number greater than 4.

(ii) six appears on at least one die.

Ans. S = {1, 2, 3, 4, 5, 6} $\Rightarrow n(S)$ = 6

(i) Let A be the set of favourable events. $\Rightarrow n(A)$ = 1

$\therefore P(A) = \frac{n(S)}{n(A)} = \frac{2}{6} = \frac{1}{3}$ and $P(\overline{A}) = 1 - \frac{1}{3} = \frac{2}{3}$

$n = 2, r = 0, 1, 2$

P (X = 0) = $P(\overline{A})P(\overline{A}) = \frac{2}{3} \times \frac{2}{3} = \frac{4}{9}$

P (X = 1) = 2 P (A) $P(\overline{A}) = 2 \times \frac{1}{3} \times \frac{2}{3} = \frac{4}{9}$

P (X = 2) = P (A). P (A) = $\frac{1}{3} \times \frac{1}{3} = \frac{1}{9}$

Probability distribution

X	0	1	2
$P(X)$	$\frac{4}{9}$	$\frac{4}{9}$	$\frac{1}{9}$

(ii) Let A represents that 6 appears on one die $\Rightarrow$ A = {6} $\Rightarrow n(A)$ = 1

$\therefore P(A) = \frac{n(S)}{n(A)} = \frac{1}{6}$ and $P(\overline{A}) = 1 - \frac{1}{6} = \frac{5}{6}$

Let s denotes success and f denotes the failure. Then

P (s) = P (6 appears on at least one die)

= P (6 appears on one die or 6 appears on both dice)

= P (6 appears on first dice and does not appear on second dice) + P (6 does not appear on first dice and 6 appears on second dice) + P (6 appears on both dice)

= $\frac{1}{6} \times \frac{5}{6} + \frac{5}{6} \times \frac{1}{6} + \frac{1}{6} \times \frac{1}{6} = \frac{11}{36}$

Let X denotes the numebr of success in two tosses of a dice, then X can take value 0 or 1.

P (X = 0) = P (no success) = P(f) = $P(\overline{A})P(\overline{A})$ = $\frac{5}{6}\times\frac{5}{6}=\frac{25}{36}$

P (X = 1) = P (one success) = P(s) = $\frac{11}{36}$

Probability distribution

X	0	1
P(X)	$\frac{25}{36}$	$\frac{11}{36}$

6. From a lot of 30 bulbs which include 6 defectives, a sample of 4 bulbs is drawn at random with replacement. Find the probability distribution of the number of defective bulbs.

Ans. $n(S)$ = 30, A = {6 defective bulbs} $\Rightarrow n(A)$ = 6

$p=\frac{n(A)}{n(S)}=\frac{6}{30}=\frac{1}{5}$ and $q=1-\frac{1}{5}=\frac{4}{5}$

n =4 (4 bulbs are drawn with replacement), r = 0, 1, 2, 3, 4

P (X = 0) = $(q)^4=\left(\frac{4}{5}\right)^4=\frac{256}{625}$

P (X = 1) = ${}^4C_1(p)q^3=4\times\frac{1}{5}\times\left(\frac{4}{5}\right)^3=\frac{256}{625}$

P (X = 2) = ${}^4C_2p^2q^2=6\times\left(\frac{1}{5}\right)^2\times\left(\frac{4}{5}\right)^2=\frac{96}{625}$

P (X = 3) = $^4C_3 p^3 q = 4 \times \left(\frac{1}{5}\right)^3 \times \left(\frac{4}{5}\right) = \frac{16}{625}$

P (X = 4) = $^4C_4 p^4 = \left(\frac{1}{5}\right)^4 = \frac{1}{625}$

Probability distribution:

X_i	0	1	2	3	4
$P(X_i)$	$\frac{256}{625}$	$\frac{256}{625}$	$\frac{96}{625}$	$\frac{16}{625}$	$\frac{1}{625}$

7. A coin is biased so that the head is 3 times as likely to occur as tail. If the coin is tossed twice, find the probability distribution of number of tails.

Ans. Let p represents the appearance of tail and q represents the appearance of head.

Now $q = 3p$

Since $p + q = 1 \Rightarrow p + 3p = 1 \Rightarrow p = \frac{1}{4}$ and $q = 1 - \frac{1}{4} = \frac{3}{4}$

P (X = 0) = $^2C_0 (q)^2 = \left(\frac{3}{4}\right)^2 = \frac{9}{16}$

P (X = 1) = $^2C_1 q.p = 2 \times \frac{3}{4} \times \frac{1}{4} = \frac{6}{16}$

P (X = 2) = $^2C_2 p^2 = \left(\frac{1}{4}\right)^2 = \frac{1}{16}$

Probability distribution:

x_i	0	1	2
p_i	$\frac{9}{16}$	$\frac{6}{16}$	$\frac{1}{16}$

8. A random variable X has the following probability distribution:

X	0	1	2	3	4	5	6	7
P (X)	0	k	$2k$	$2k$	$3k$	k^2	$2k^2$	$2k^2+k$

Determine:

(i) k

(ii) P (X < 3)

(iii) P (X > 6)

(iv) P (0 < X < 3)

Ans. (i) Since, the sum of all the probabilities of a distribution is 1.

$\therefore$ P (X = 0) + P (X = 1) + ... + P (X = 7) = 1

$\Rightarrow 0+k+2k+2k+3k+k^2+2k^2+7k^2+k=1$

$\Rightarrow 10k^2+9k-1=0$

$\Rightarrow (10k-1)(k+1)=0$

$\Rightarrow 10k-1=0$ or $k+1=0$

$\Rightarrow k=\frac{1}{10}$ or $k=-1$

Since, $k \geq 0$, therefore $k=-1$ is not possible.

$\therefore k=\frac{1}{10}$

(ii) P (X < 3) = P (X = 0) + P (X = 1) + P (X = 2)

= $0+k+2k$

= $3k=3\times\frac{1}{10}=\frac{3}{10}$

(iii) P (X > 6) = P (X = 7)

$$= 7k^2 + k = 7\left(\frac{1}{10}\right)^2 + \frac{1}{10} = \frac{17}{100}$$

(iv) P (0 < X < 3)

= P (X = 1) + P (X = 2)

$$= k + 2k = 3k = \frac{3}{10}$$

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9. The random variable X has a probability distribution $\mathrm{P}(x)$ of the following form, where k is some number:

$$\mathrm{P}(x) = \begin{cases} k \text{ if} & x = 0 \\ 2k \text{ if} & x = 1 \\ 3k \text{ if} & x = 2 \\ 0 & \text{otherwise} \end{cases}$$

(a) Determine the value of k.
(b) Find $\mathrm{P}(x < 2), \mathrm{P}(x \le 2), \mathrm{P}(x \ge 2)$

Ans. Probability distribution:

x_i	0	1	2
$\mathrm{P}(x_i)$	k	$2k$	$3k$

(a) P (X = 0) + P (X = 1) + P (X = 2) = 1

$$\Rightarrow k + 2k + 3k = 1 \Rightarrow 6k = 1$$

$$\Rightarrow k = \frac{1}{6}$$

(b) P (X < 2) = P (X = 0) + P (X = 1)

$= k + 2k = 3k = 3 \times \frac{1}{6} = \frac{1}{2}$

P (X $\geq$ 2) = P (X = 2) = $3k = 3 \times \frac{1}{6} = \frac{1}{2}$

10. Find the mean number of heads in three tosses of fair coin.

Ans. $n(\mathrm{S}) = 8$

Let A denotes the appearance of head on a toss.

A = $\{h\} \Rightarrow n(\mathrm{A}) = 1$

$\therefore p = \frac{n(\mathrm{A})}{n(\mathrm{S})} = \frac{1}{2}$ and $q = 1 - p = 1 - \frac{1}{2} = \frac{1}{2}$

$n = 3$, $r = 0, 1, 2, 3$

P (X = 0) = $q^3 = \left(\frac{1}{2}\right)^3 = \frac{1}{8}$

P (X = 1) = $3q^2p = 3\left(\frac{1}{2}\right)^2\left(\frac{1}{2}\right) = \frac{3}{8}$

P (X = 2) = $3qp^2 = 3\left(\frac{1}{2}\right)\left(\frac{1}{2}\right)^2 = \frac{3}{8}$

P (X = 3) = $p^3 = \left(\frac{1}{2}\right)^3 = \frac{1}{8}$

Probability distribution:

X_i	0	1	2	3
P_i	$\frac{1}{8}$	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{1}{8}$

Mean = $\sum p_i x_i = 0\times\frac{1}{8}+1\times\frac{3}{8}+2\times\frac{3}{8}+3\times\frac{1}{8}$ = $\frac{12}{8}=\frac{3}{2}$

11. Two dice are thrown simultaneously. If X denotes the number of sixes, find expectation of X.

Ans. Two dice thrown simultaneously is the same the die thrown 2 times.

Let S = {1, 2, 3, 4, 5, 6} $\Rightarrow n(S)$ = 6 x 6 = 36

Let A denotes the number 6 $\Rightarrow$ A = {6} $\Rightarrow n(A)=1$

P (A) = $\frac{n(A)}{n(S)}=\frac{1}{6}$ and $P(\overline{A})=1-\frac{1}{6}=\frac{5}{6}$

n = 2, r = 0, 1, 2

P (X = 0) = $P(\overline{A})P(\overline{A})=\left(\frac{5}{6}\right)^2=\frac{25}{36}$

P (X = 1) = 2 P (A). $P(\overline{A})=2\times\frac{1}{6}\times\frac{5}{6}=\frac{10}{36}$

P (X = 2) = P (A). P (A) = $\frac{1}{6}\times\frac{1}{6}=\frac{1}{36}$

E (X) = $\sum_{i=1}^{2} x_i p(x_i)=0\times\frac{25}{36}+1\times\frac{10}{36}+2\times\frac{1}{36}=\frac{12}{36}=\frac{1}{3}$

12. Two numbers are selected at random (without replacement), from the first six positive integers. Let X denotes the larger of two numbers obtained. Find E (X).

Ans. S = {(1, 2), (2, 1), (3, 1), (4, 1), (5, 1), (6, 1),

(1, 3), (2, 3), (3, 2), (4, 2), (5, 2), (6, 2),

(1, 4), (2, 4), (3, 4), (4, 3), (5, 3), (6, 3),

(1, 5), (2, 5), (3, 5), (4, 5), (5, 4), (6, 4), (1, 6), (2, 6), (3, 6), (4, 6), (5, 6), (6, 6)}

$n(S)$ = 30

Let X denotes the larger of the two numbers obtained.

x_i	f_i	p_i	$p_i x_i$
2	2	$\frac{2}{30}$	$\frac{4}{30}$
3	4	$\frac{4}{30}$	$\frac{12}{30}$
4	6	$\frac{6}{30}$	$\frac{24}{30}$
5	8	$\frac{8}{30}$	$\frac{40}{30}$
6	10	$\frac{10}{30}$	$\frac{60}{30}$
	30		$\sum p_i x_i = \frac{140}{30}$

E (X) = $\sum p_i x_i$ = $\frac{140}{30} = \frac{14}{3} = 4\frac{2}{3}$

13. Let X denotes the sum of the numbers obtained when two fair dice are rolled. Find the variance and standard deviation of X.

Ans. S = {(1, 1), (2, 1), (3, 1), (4, 1), (5, 1), (6, 1),

(1, 2), (2, 2), (3, 2), (4, 2), (5, 2), (6, 2),

(1, 3), (2, 3), (3, 3), (4, 3), (5, 3), (6, 3),

(1, 4), (2, 4), (3, 4), (4, 4), (5, 4), (6, 4),

(1, 5), (2, 5), (3, 5), (4, 5), (5, 5), (6, 5),

(1, 6), (2, 6), (3, 6), (4, 6), (5, 6), (6, 6)}

$n\left(\mathrm{S}\right)$ = 36

Let A denotes the sum of the numbers = 2, B denotes the sum of the numbers = 3

C denotes the sum of the numbers = 4, D denotes the sum of the numbers = 5

E denotes the sum of the numbers = 6, F denotes the sum of the numbers = 7

G denotes the sum of the numbers = 8, H denotes the sum of the numbers = 9

I denotes the sum of the numbers = 10, J denotes the sum of the numbers = 11

K denotes the sum of the numbers = 12

A = {1, 1}, $n\left(\mathrm{A}\right)$ = 1, P (A) = $\frac{1}{36}$

B = {(1, 2), (2, 1)}, $n\left(\mathrm{B}\right)$ = 2, P (A) = $\frac{2}{36}$

C = {(1, 3), (2, 2), (3, 1)}, $n\left(\mathrm{C}\right)$ = 3, P (A) = $\frac{3}{36}$

D = {(1, 4), (2, 3), (3, 2), (4, 1)}, $n\left(\mathrm{D}\right)$ = 4, P (A) = $\frac{4}{36}$

E = {(1, 5), (2, 4), (3, 3), (4, 2), (5, 1)},

$n\left(\mathrm{E}\right)$ = 5, P (A) = $\frac{5}{36}$

F = {(1, 6), (2, 5), (3, 4), (4, 3), (5, 2), (6, 1)},

$n\left(\mathrm{F}\right)$ = 6, P (A) = $\frac{6}{36}$

G = {(2, 6), (3, 5), (4, 4), (5, 3), (6, 2)},

$n\left(\mathrm{G}\right)$ = 5, P (A) = $\frac{5}{36}$

H = {(3, 6), (4, 5), (5, 4), (6, 3)},

$n\left(\mathrm{H}\right)$ = 4, P (A) = $\frac{4}{36}$

I = {(4, 6), (5, 5), (6, 4)},

$n(\mathrm{I})$ = 3, P (A) = $\frac{3}{36}$

J = {(5, 6), (6, 5)},

$n(\mathrm{J})$ = 2, P (A) = $\frac{2}{36}$

K = {6, 6}, $n(\mathrm{K})$ = 1, P (A) = $\frac{1}{36}$

x_i	$\mathrm{P}(x_i)$	x_i	$\mathrm{P}(x_i)$	x_i	$\mathrm{P}(x_i)$
2	$\frac{1}{36}$	6	$\frac{5}{36}$	10	$\frac{3}{36}$
3	$\frac{2}{36}$	7	$\frac{6}{36}$	11	$\frac{2}{36}$
4	$\frac{3}{36}$	8	$\frac{5}{36}$	12	$\frac{1}{36}$
5	$\frac{4}{36}$	9	$\frac{4}{36}$		

Mean = $\mu = \sum p_i x_i$

= $\frac{1}{36}\times 1+\frac{2}{36}\times 3+\frac{3}{36}\times 4+\frac{4}{36}\times 5+\frac{5}{36}\times 6+\frac{6}{36}\times 7+\frac{5}{36}\times 8+\frac{4}{36}\times 9+\frac{3}{36}\times 10+\frac{2}{36}\times 11+\frac{1}{36}\times 12$

= $\frac{1}{36}(2+6+12+20+30+42+40+36+30+22+12)$

= $\frac{252}{36}=7$

Now $\sum p_i x_i^2$ = $\frac{1}{36}(2)^2+\frac{2}{36}(3)^2+\frac{3}{36}(4)^2+\frac{4}{36}(5)^2+\frac{5}{36}(6)^2+\frac{6}{36}(7)^2+\frac{5}{36}(8)^2+\frac{4}{36}(9)^2$

$+\frac{3}{36}(10)^2+\frac{2}{36}(11)^2+\frac{1}{36}(12)^2$

= $\frac{1}{36}(4+18+48+100+180+294+320+324+300+242+144)$

= $\frac{1}{36}\times 1974=\frac{329}{6}$

Variance = $\sum p_i x_i^2-\left(\sum p_i x_i\right)^2$ = $\frac{329}{6}-(7)^2$ = 54.83 – 49 = 5.83

Standard deviation = $\sqrt{5.83}=2.4$ (nearly)

14. A class has 15 students whose ages are 14, 17, 15, 14, 21, 17, 19, 20, 16, 18, 20, 17, 16, 19 and 20 years. One student is selected in such a manner that each has the same chance of being chosen and the age X of the selected student is recorded. What is the probability distribution of the random variable X? Find mean, variance and standard deviation of X.

Ans. $n(S)$ = 15, P (A) = $\frac{1}{15}$

x_i	f_i	p_i	$p_i x_i$	$p_i x_i^2$
14	2	$\frac{2}{15}$	$\frac{28}{15}$	$\frac{392}{15}$
15	1	$\frac{1}{15}$	$\frac{15}{15}$	$\frac{225}{15}$
16	2	$\frac{2}{15}$	$\frac{32}{15}$	$\frac{512}{15}$
17	3	$\frac{3}{15}$	$\frac{51}{15}$	$\frac{867}{15}$
18	1	$\frac{1}{15}$	$\frac{18}{15}$	$\frac{324}{15}$

19 20 21	2 3 1	$\frac{2}{15}$ $\frac{3}{15}$ $\frac{1}{15}$	$\frac{38}{15}$ $\frac{60}{15}$ $\frac{21}{15}$	$\frac{722}{15}$ $\frac{1200}{15}$ $\frac{441}{15}$
	15		$\sum p_i x_i = \frac{263}{15}$	$\sum p_i x_i^2 = \frac{4683}{15}$

Mean = $\sum p_i x_i = \frac{263}{15}$ = 17.53

Variance = $\sum p_i x_i^2 - \left(\sum p_i x_i\right)^2$ = $\frac{4683}{15} - \left(\frac{263}{15}\right)^2 = 312.20 - (17.53)^2$

= 312.20 – 307.42 = 4.78

Standard deviation = $\sqrt{4.78} = 2.19$

15. In a meeting 70% of the members favour a certain proposal, 30% being opposed. A member is selected at random and we let X = 0 if the opposed and X = 1 if he is in favour. Find E (X) and Var (X).

Ans.

x_i	p_i	$p_i x_i$	$p_i x_i^2$
0 1	$\frac{30}{100}$ $\frac{70}{100}$	0 $\frac{70}{100}$	0 $\frac{70}{100}$
		$\sum p_i x_i = \frac{70}{100}$	$\sum p_i x_i^2 = \frac{70}{100}$

E (X) = Mean = $\sum p_i x_i = \frac{70}{100}$ = 0.7

Variance (X) = $\sum p_i x_i^2 - \left(\sum p_i x_i\right)^2 = \frac{70}{100} - \left(\frac{70}{100}\right)^2 = \frac{7}{10} - \frac{49}{100} = \frac{21}{100} = 0.21$

Choose the correct answer in each of the following:

16. The mean of the numbers obtained on throwing a die having written 1 on three faces, 2 on two faces and 5 on one face is:

(A) 1
(B) 2
(C) 5
(D) $\frac{8}{3}$

Ans.

x_i	p_i	$p_i x_i$
1	$\frac{3}{6}$	$\frac{3}{6}$
2	$\frac{2}{6}$	$\frac{4}{6}$
5	$\frac{1}{6}$	$\frac{5}{6}$
		$\sum p_i x_i = \frac{12}{6} = 2$

Therefore, option (B) is correct.

17. Suppose that two cards are drawn at random from a deck of cards. Let X be the number of aces obtained. What is the value of E(X)?

(A) $\frac{37}{221}$

(B) $\frac{5}{13}$

(C) $\frac{1}{13}$

(D) $\frac{2}{13}$

Ans. $n(\mathrm{S})$ = 52, $n(\mathrm{A})$ = 4

P (X = 0) = $\frac{^{48}C_2}{^{52}C_2}=\frac{48\times 47}{52\times 51}=\frac{188}{221}$

x_i	p_i	$p_i x_i$
0	$\frac{188}{221}$	0
1	$\frac{32}{221}$	$\frac{32}{221}$
2	$\frac{1}{221}$	$\frac{2}{221}$
		$\sum p_i x_i=\frac{34}{221}=\frac{2}{13}$

P (X = 1) = $\frac{^{48}C_2\times {}^{4}C_1}{^{52}C_2}=\frac{2\times 48\times 4}{52\times 51}=\frac{32}{221}$

P (X = 2) = $\frac{^{4}C_2}{^{52}C_2}=\frac{4\times 3}{52\times 51}=\frac{1}{221}$

Now E (X) = $\frac{2}{13}$

Therefore, option (D) is correct.