RD Sharma Solutions Class 12 Maths Chapter 32 Ex 32.2

Mean and Variance of a Random Variable Ex 32.2 Q1(i)

x_i	p_i	$p_i x_i$	$p_i x_i^2$
2	0.2	0.4	0.8
3	0.5	1.5	4.5
4	0.3	1.2	4.8
		$\Sigma p_i x_i = 3.1$	$\Sigma p_i x_i^2 = 10.1$

$$\text{Mean} = \Sigma p_i x_i = 3.1$$

$$\text{Variance} = \Sigma p_i x_i^2 - (\Sigma p_i x_i)^2 = 10.1 - (3.1)^2 = 0.49$$

$$\text{Standard deviation} = \sqrt{\text{Variance}} = 0.7$$

Mean and Variance of a Random Variable Ex 32.2 Q1(ii)

x_i	p_i	$x_i\ p_i$	$x_i^2 p_i$
1	0.4	0.4	0.4
3	0.1	0.3	0.9
4	0.2	0.8	3.2
5	0.3	1.5	7.5
		$\Sigma xp = 3$	$\Sigma x^2 p = 12$

$$\text{Mean} = \Sigma xp$$
$$\text{mean} = 3$$

$$\text{Standard deviation} = \sqrt{\Sigma x^2 p - (\text{mean})^2}$$
$$= \sqrt{12 - (3)^2}$$
$$= \sqrt{3}$$

Standard Deviation = 1.732

Mean and Variance of a Random Variable Ex 32.2 Q1(iii)

x_i	p_i	$x_i p_i$	$x_i^2 p_i$
-5	$\frac{1}{4}$	$-\frac{5}{4}$	$\frac{25}{4}$
-4	$\frac{1}{8}$	$-\frac{1}{2}$	2
1	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$
2	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{2}$
		$\Sigma xp = -1$	$\Sigma x^2 p = \frac{37}{4}$

Mean = Σxp

mean = -1

Standard deviation = $\sqrt{\Sigma x^2 p - (\text{mean})^2}$

$= \sqrt{\frac{37}{4} - (-1)^2}$

$= \sqrt{\frac{33}{4}}$

$= \sqrt{8.25}$

Standard Deviation = 2.9

Mean and Variance of a Random Variable Ex 32.2 Q1(iv)

x_i	p_i	$x_i p_i$	$x_i^2 p_i$
-1	0.3	-0.3	0.3
0	0.1	0	0
1	0.1	0.1	0.1
2	0.3	0.6	1.2
3	0.2	0.6	1.8
		$\Sigma xp = 1$	$\Sigma x^2 p = 3.4$

Mean = Σxp

mean = 1

Standard deviation = $\sqrt{\Sigma x^2 p - (\text{mean})^2}$

$= \sqrt{(3.4) - (1)^2}$

$= \sqrt{2.4}$

Standard Deviation = 1.5

Mean and Variance of a Random Variable Ex 32.2 Q1(v)

x_i	p_i	$x_i p_i$	$x_i^2 p_i$
1	0.4	0.4	0.4
2	0.3	0.6	1.2
3	0.2	0.6	1.8
4	0.1	0.4	1.6
		$\Sigma xp = 2$	$\Sigma x^2p = 5$

Mean = Σxp
mean = 2

Standard deviation = $\sqrt{\Sigma x^2p - (\text{mean})^2}$
$= \sqrt{5 - (2)^2}$

Standard Deviation = 1

Mean and Variance of a Random Variable Ex 32.2 Q1(vi)

x_i	p_i	$x_i p_i$	$x_i^2 p_i$
0	0.2	0	0
1	0.5	0.5	0.5
3	0.2	0.6	1.8
5	0.1	0.5	2.5
		$\Sigma xp = 1.6$	$\Sigma x^2p = 4.8$

Mean = Σxp
mean = 1.6

Standard deviation = $\sqrt{\Sigma x^2p - (\text{mean})^2}$
$= \sqrt{4.8 - (1.6)^2}$
$= \sqrt{4.8 - 2.56}$
$= \sqrt{2.24}$

Standard Deviation = 1.497

Mean and Variance of a Random Variable Ex 32.2 Q1(vii)

x_i	p_i	$x_i\ p_i$	$x_i^2 p_i$
-2	0.1	-0.2	0.4
-1	0.2	-0.2	0.2
0	0.4	0	0
1	0.2	0.2	0.2
2	0.1	0.2	0.4
		$\Sigma xp = 0$	$\Sigma x^2p = 1.2$

Mean = Σxp
mean = 0

Standard deviation = $\sqrt{\Sigma x^2p - (\text{mean})^2}$

$= \sqrt{(1.2)^2 - (0)^2}$

Standard Deviation = 1.2

Mean and Variance of a Random Variable Ex 32.2 Q1(viii)

x_i	p_i	$x_i\ p_i$	$x_i^2 p_i$
-3	0.05	-0.15	0.45
-1	0.45	-0.45	0.45
0	0.20	0	0
1	0.25	0.25	0.25
3	0.05	0.15	0.45
		$\Sigma xp = -0.2$	$\Sigma x^2p = 1.6$

Mean = Σxp
mean = −0.2

Standard deviation = $\sqrt{\Sigma x^2p - (\text{mean})^2}$

$= \sqrt{1.6 - (-0.2)^2}$
$= \sqrt{1.6 - 0.04}$
$= \sqrt{1.56}$

Standard Deviation = 1.249

Mean and Variance of a Random Variable Ex 32.2 Q1(ix)

x_i	p_i	p_ix_i	$p_ix_i^2$
0	$\frac{1}{6}$	0	0
1	$\frac{5}{18}$	$\frac{5}{18}$	$\frac{5}{18}$
2	$\frac{2}{9}$	$\frac{4}{9}$	$\frac{8}{9}$
3	$\frac{1}{6}$	$\frac{1}{2}$	$\frac{3}{2}$
4	$\frac{1}{9}$	$\frac{4}{9}$	$\frac{16}{9}$
5	$\frac{1}{18}$	$\frac{5}{18}$	$\frac{25}{18}$
		$\Sigma p_ix_i = \frac{35}{18}$	$\Sigma p_ix_i^2 = \frac{35}{6}$

$$\text{Mean} = \Sigma p_ix_i = \frac{35}{18}$$

$$\text{Variance} = \Sigma p_ix_i^2 - (\Sigma p_ix_i)^2 = \frac{35}{6} - \left(\frac{35}{18}\right)^2 = \frac{665}{324}$$

$$\text{Standard deviation} = \sqrt{\text{Variance}} = \frac{\sqrt{665}}{18}$$

Mean and Variance of a Random Variable Ex 32.2 Q2

(i) We know that,

$$P(0.5)+P(1)+P(1.5)+P(2)=1$$
$$k+k^2+2k^2+k=1$$
$$3k^2+2k-1=0$$
$$3k^2+3k-k-1=0$$
$$(3k-1)(k+1)=0$$
$$k=\frac{1}{3} \text{ or } k=-1$$

We know that $0 \le P(X) \le 1$

$$\therefore k=\frac{1}{3}$$

(ii)

x_i	p_i	$p_i x_i$
0.5	$\frac{1}{3}$	$\frac{1}{6}$
1	$\frac{1}{9}$	$\frac{1}{9}$
1.5	$\frac{2}{9}$	$\frac{1}{3}$
2	$\frac{1}{3}$	$\frac{2}{3}$
		$\sum p_i x_i = \frac{23}{18}$

$$\text{Mean} = \sum p_i x_i = \frac{23}{18}$$

Mean and Variance of a Random Variable Ex 32.2 Q3

x_i	p_i	$x_i\ p_i$	$x_i^2 p_i$
a	p	ap	a^2p
b	q	bq	b^2q

Mean $= \sum xp$

mean $= ap+bq$

Variance $= \sum x^2p - (\text{mean})^2$

$$= (a^2p+b^2q)-(ap+bq)^2$$
$$= a^2p+b^2q-a^2p^2-b^2q^2-2abpq$$
$$= a^2pq+b^2pq-2abpq \qquad [\because \quad p+q=1]$$
$$= pq(a^2+b^2-2ab)$$

Variance $= pq(a-b)^2$

Standard deviation $= |a-b|\sqrt{pq}$

Mean and Variance of a Random Variable Ex 32.2 Q4

We know that in a throw of coin.

$P(H) = \frac{1}{2}, \qquad P(T) = \frac{1}{2}$

Let X denote the number of heads in three tosses of coin.

So, $X = 0,1,2,3$

$$P(x = 0) = P(T)P(T)P(T)$$
$$= \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2}$$
$$= \frac{1}{8}$$
$$P(x = 1) = P(H)P(T)P(T) + P(T)P(H)P(T) + P(T)P(T)P(H)$$
$$= \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} + \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} + \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2}$$
$$= \frac{3}{8}$$
$$P(x = 2) = P(H)P(H)P(T) + P(H)P(T)P(H) + P(T)P(H)P(H)$$
$$= \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} + \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} + \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2}$$
$$= \frac{3}{8}$$
$$P(x = 3) = P(H)P(H)P(H)$$
$$= \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2}$$
$$= \frac{1}{8}$$

So,

x_i	p_i	$x_i\ p_i$	$x_i^2 p_i$
0	$\frac{1}{8}$	0	0
1	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{3}{8}$
2	$\frac{3}{8}$	$\frac{6}{8}$	$\frac{12}{8}$
3	$\frac{1}{8}$	$\frac{3}{8}$	$\frac{9}{8}$
		$\Sigma xp = \frac{3}{2}$	$\Sigma x^2 p = 3$

Mean $= \Sigma xp$

mean $= \frac{3}{2}$

$$\text{Variance} = \Sigma x^2 p - (\text{mean})^2$$
$$= 3 - \frac{9}{4}$$

$$\text{Variance} = \frac{3}{4}$$

Mean and Variance of a Random Variable Ex 32.2 Q5

Two cards are drawn simultneously from a pack of 52 cards.
Let X denotes the number of kings drawn.

So, $X = 0,1,2$

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

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

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

So,

x_i	p_i	$x_i p_i$	$x_i^2 p_i$
0	$\frac{188}{221}$	0	0
1	$\frac{32}{221}$	$\frac{32}{221}$	$\frac{32}{221}$
2	$\frac{1}{221}$	$\frac{2}{221}$	$\frac{4}{221}$
		$\Sigma xp = \frac{34}{221}$	$\Sigma x^2 p = \frac{36}{221}$

Mean $= \Sigma xp$

$$\text{mean} = \frac{34}{221}$$

$$\text{Variance} = \Sigma x^2 p - (\text{mean})^2 = \frac{36}{221} - \left(\frac{34}{221}\right)^2 = \frac{7956 - 1156}{48841} = \frac{6800}{48841}$$

$$\text{Variance} = \frac{400}{2873}$$

Mean and Variance of a Random Variable Ex 32.2 Q6

We know that ,in a throw of coin.

$P(T) = \frac{1}{2}, \qquad P(H) = \frac{1}{2}$

Let X denote the number of tails in three throws of coins.

So, X can take values from 0,1,2,3

$$P(x=0) = P(H)P(H)P(H)$$
$$= \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2}$$
$$= \frac{1}{8}$$
$$P(x=1) = P(T)P(H)P(H) + P(H)P(T)P(H) + P(H)P(H)P(T)$$
$$= \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} + \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} + \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2}$$
$$= \frac{3}{8}$$
$$P(x=2) = P(T)P(T)P(H) + P(T)P(H)P(T) + P(H)P(T)P(T)$$
$$= \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} + \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} + \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2}$$
$$= \frac{3}{8}$$
$$P(x=3) = P(T)P(T)P(T)$$
$$= \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2}$$
$$= \frac{1}{8}$$

So,

Mean $= \sum xp$

mean $= \frac{3}{2}$

$$\text{Variance} = \sum x^2 p - (\text{mean})^2$$
$$= 3 - \left(\frac{3}{2}\right)^2$$
$$= 3 - \frac{9}{4}$$

$$\text{Variance} = \frac{3}{4}$$

$$\text{Standard Deviation} = \sqrt{\text{Variance}}$$
$$= \sqrt{\frac{3}{4}}$$

Standard Deviation = 0.87

Mean and Variance of a Random Variable Ex 32.2 Q7

Total 12 good and bad eggs. 10 are good and 2 are bad.
3 eggs are drawn from this lot
Let X be the random variable that denotes the number of bad eggs in the lot.

$P(X = 0) = P(3\text{good and } 0 \text{ bad}) = {}^{3}C_0.{}^{10}C_3/{}^{12}C_3$

$= 1 \times 120/220 = 6/11$

$P(X = 1) = P(2\text{good and } 1 \text{ bad}) = {}^{2}C_1.{}^{10}C_2/{}^{12}C_3$

$= 2\times 45/220 = 9/22$

$P(X = 2) = P(1\text{good and } 2 \text{ bad}) = {}^{2}C_2.{}^{10}C_1/{}^{12}C_3$

$= 1\times 10/220 = 1/22$

The probability distribution of X is

X	0	1	2
P(X)	$\frac{6}{11}$	$\frac{9}{22}$	$\frac{1}{22}$

The mean $= 0 \times \frac{6}{11} + 1 \times \frac{9}{22} + 2 \times \frac{1}{22} = \frac{11}{22} = 1/2$

Mean and Variance of a Random Variable Ex 32.2 Q8

A pair of dice is thrown. And X denote minimum of the two number appeared.
So, X can have values 2,3,4,5,6.

$P(x = 1) = \frac{11}{36}$ [Possible pairs: (1,1), (1,2), (1,3), (1,4), (1,5), (1,6), (2,1), (3,1), (4,1), (5,1), (6,1)]

$P(x = 2) = \frac{9}{36}$ [Possible pairs: (2,2), (2,3), (2,4), (2,5), (2,6), (3,2), (4,2), (5,2), (6,2)]

$P(x = 3) = \frac{7}{36}$ [Possible pairs: (3,3), (3,4), (3,5), (3,6), (4,3), (5,3), (6,3)]

$P(x = 4) = \frac{5}{36}$ [Possible pairs: (4,4), (4,5), (4,6), (5,4), (6,4)]

$P(x = 5) = \frac{3}{36}$ [Possible pairs: (5,5), (5,6), (6,5)]

$P(x = 6) = \frac{1}{36}$ [Possible pairs: (6,6)]

x_i	p_i	$x_i p_i$	$x_i^2 p_i$
1	$\frac{11}{36}$	$\frac{11}{36}$	$\frac{11}{36}$
2	$\frac{9}{36}$	$\frac{18}{36}$	$\frac{36}{36}$
3	$\frac{7}{36}$	$\frac{21}{36}$	$\frac{63}{36}$
4	$\frac{5}{36}$	$\frac{20}{36}$	$\frac{80}{36}$
5	$\frac{3}{36}$	$\frac{15}{36}$	$\frac{75}{36}$
6	$\frac{1}{36}$	$\frac{6}{36}$	$\frac{36}{36}$
		$\Sigma xp = \frac{91}{36}$	$\Sigma x^2p = \frac{301}{36}$

Mean = Σxp

Mean = $\frac{91}{36}$

$$\text{Variance} = \Sigma x^2p - (\text{mean})^2$$

$$= \frac{301}{36} - \left(\frac{91}{36}\right)^2$$

$$= \frac{10836 - 8281}{1296}$$

$$= \frac{2555}{1296}$$

Variance = 1.97

Probability distribution is

x :	1	2	3	4	5	6
$P(x)$:	$\frac{11}{36}$	$\frac{9}{36}$	$\frac{7}{36}$	$\frac{5}{36}$	$\frac{3}{36}$	$\frac{1}{36}$

Mean and Variance of a Random Variable Ex 32.2 Q9

We know that ,In a toss of coin.

$P(T) = \frac{1}{2}, \qquad P(H) = \frac{1}{2}$

Let X denote the number of occuring head in 4 throws of coins.

So, X can take values from $X = 0,1,2,3,4$

$$\begin{aligned} P(x = 0) &= P(T)P(T)P(T)P(T) \\ &= \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \\ &= \frac{1}{16} \end{aligned}$$

$$\begin{aligned} P(x = 1) &= P(H)P(T)P(T)P(T) \times {}^4C_1 \\ &= \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times 4 \\ &= \frac{4}{16} \end{aligned}$$

$$\begin{aligned} P(x = 2) &= P(H)P(H)P(T)P(T) \times {}^4C_2 \\ &= \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times 6 \\ &= \frac{6}{16} \end{aligned}$$

$$\begin{aligned} P(x = 3) &= P(H)P(H)P(H)P(T) \times {}^4C_3 \\ &= \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times 4 \\ &= \frac{4}{16} \end{aligned}$$

$$\begin{aligned} P(x = 4) &= P(H)P(H)P(H)P(H) \\ &= \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \\ &= \frac{1}{16} \end{aligned}$$

So,

Mean $= \sum xp$
mean $= 2$

Variance $= \sum x^2 p - (\text{mean})^2$
$= 5 - (2)^2$
Variance $= 1$

Probability distribution is

x :	0	1	2	3	4
$P(x)$:	$\frac{1}{16}$	$\frac{4}{16}$	$\frac{6}{16}$	$\frac{4}{16}$	$\frac{1}{16}$

Mean and Variance of a Random Variable Ex 32.2 Q10

X denotes twice the number appearing on the die.
So, $X = 2,4,6,8,10,12.$

Probability distribution is

X :	2	4	6	8	10	12
$P(x)$:	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$

Mean = $\sum xp$
mean = 7

$$\text{Variance} = \sum x^2p - (\text{mean})^2$$
$$= \left(\frac{364}{6}\right) - (7)^2$$
$$= \frac{364 - 294}{6}$$
$$= \frac{70}{6}$$

Variance = 11.7

Mean and Variance of a Random Variable Ex 32.2 Q11

Probability of even number = $P(E) = \frac{3}{6} = \frac{1}{2}$

$\Rightarrow \quad P(O) = \frac{1}{2}$

Here, X have values 1 or 3 according as an odd or even number.

So,

X :	1	3
$P(x)$:	$\frac{1}{2}$	$\frac{1}{2}$

x_i	p_i	$x_i\ p_i$	$x_i^2 p_i$
1	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$
3	$\frac{1}{2}$	$\frac{3}{2}$	$\frac{9}{2}$
		$\sum xp = 2$	$\sum x^2p = 5$

Mean = $\sum xp$
mean = 2

$$\text{Variance} = \sum x^2p - (\text{mean})^2$$
$$= 5 - 4$$

Variance = 1

Mean and Variance of a Random Variable Ex 32.2 Q12

Let the event of getting a head = H and getting a tail = T
Let X denote the variable longest consecutive heads occurring in 4 tosses. The possible values are

X = 0 (no head) {T, T, T, T}
X = 1 (1 heads) {H, T, T, T}
X = 2 (2 heads) {H, H, T, T}
X = 3 (3 heads) {H, H, H, T}
X = 4 (4 heads) {H, H, H, H}

n(S) = {(HHHH),(HHHT),(HHTT),(HTHH),(HTHT),(HTTH),(HTTT),
(THHH),(THTH),(THHT),(THTT),(THTT),(TTHH),(TTHT)
(TTTH),(TTTT)}

$P(X=0) = \frac{1}{16}$

$P(X=1) = \frac{7}{16}$

$P(X=2) = \frac{5}{16}$

$P(X=3) = \frac{2}{16}$

$P(X=4) = \frac{1}{16}$

Probability distribution is

X	0	1	2	3	4
$p_i = P(X)$	$\frac{1}{16}$	$\frac{7}{16}$	$\frac{5}{16}$	$\frac{2}{16}$	$\frac{1}{16}$
$p_i x_i^2$	0	$\frac{7}{16}$	$\frac{20}{16}$	$\frac{18}{16}$	1

Mean = $\sum_{i=1\ to\ n} X_i \times P(X_i)$

Mean, $\mu = 0 \times \frac{1}{16} + 1 \times \frac{7}{16} + 2 \times \frac{5}{16} + 3 \times \frac{2}{16} + 4 \times \frac{1}{16}$

$= 0 + \frac{7}{16} + \frac{10}{16} + \frac{6}{16} + \frac{4}{16}$

$= \frac{27}{16} = 1.7$

Variance Var(X) = $\sum p_i x_i^2 - (\sum p_i x_i)^2$

$= \frac{61}{16} - 1.7^2$

=3.825-2.89

= 0.935

Mean and Variance of a Random Variable Ex 32.2 Q13

Box contains five cards 1,1,2,2,3.

Here,
X denotes the sum of two number on cards drawn.
Y denotes the maximum of the two number.

So, $X = 2,3,4,5$
$Y = 1,2,3$

$$P(X=2) = P(1)P(1)$$
$$= \frac{2}{5} \times \frac{1}{4}$$
$$= 0.1$$
$$P(X=3) = P(1)P(2) + P(2)P(1)$$
$$= \frac{2}{5} \times \frac{2}{4} + \frac{2}{5} \times \frac{2}{4}$$
$$= 0.4$$
$$P(X=4) = P(2)P(2) + P(1)P(3) + P(3)P(1)$$
$$= \frac{2}{5} \times \frac{1}{4} + \frac{2}{5} \times \frac{1}{4} + \frac{1}{5} \times \frac{2}{4}$$
$$= 0.3$$
$$P(X=5) = P(2)P(3) + P(3)P(2)$$
$$= \frac{2}{5} \times \frac{1}{4} + \frac{1}{5} \times \frac{2}{4}$$
$$= 0.2$$

Probability Distribution for X

X :	2	3	4	5
$P(x)$:	0.1	0.4	0.3	0.2

Mean = $\sum xp$

mean = 3.6

Variance = $\sum x^2p - (\text{mean})^2$

$= 13.8 - (3.6)^2$

$= 13.8 - 12.96$

Variance = 0.84

$P(Y = 1) = P(1)P(1)$

$= \frac{2}{5} \times \frac{1}{4}$

$= \frac{2}{20}$

$= 0.1$

$P(Y = 2) = P(1)P(2) + P(2)P(1) + P(2)P(2)$

$= \frac{2}{5} \times \frac{2}{4} + \frac{2}{5} \times \frac{2}{4} + \frac{2}{5} \times \frac{1}{4}$

$P(Y = 2) = 0.5$

$P(Y = 3) = P(1)P(3) + P(2)P(3) + P(3)P(1) + P(3)P(2)$

$= \frac{2}{5} \times \frac{1}{4} + \frac{2}{5} \times \frac{1}{4} + \frac{1}{5} \times \frac{2}{4} + \frac{1}{5} \times \frac{2}{4}$

$= 0.4$

Probability distribution for Y is

X :	1	2	3
$P(x)$:	0.1	0.5	0.4

Y_i	p_i	$Y_i p_i$	$Y_i^2 p_i$
1	0.1	0.1	0.1
2	0.5	1.0	2.0
3	0.4	1.2	3.6
		$\sum xp = 2.6$	$\sum x^2p = 5.7$

Mean = $\sum xp$

mean = 2.3

Variance = $\sum x^2p - (\text{mean})^2$

$= 5.7 - (2.3)^2$

Variance = 0.41

Mean and Variance of a Random Variable Ex 32.2 Q14

Probability of getting an odd number $= P(O) = \frac{1}{2}$

$\Rightarrow \quad P(E) = \frac{1}{2}$

Die is tossed twice. Let X denote the number of times an odd number occurs.

So, $X = 0,1,2.$

$$P(X=0) = P(E)P(E)$$
$$= \frac{1}{2} \times \frac{1}{2}$$
$$= \frac{1}{4}$$
$$P(X=1) = P(O)P(E) + P(E)P(O)$$
$$= \frac{1}{2} \times \frac{1}{2} + \frac{1}{2} \times \frac{1}{2}$$
$$= \frac{1}{2}$$
$$P(X=2) = P(O)P(O)$$
$$= \frac{1}{2} \times \frac{1}{2}$$
$$P(X=2) = \frac{1}{4}$$

x_i	p_i	$x_i\ p_i$	$x_i^2 p_i$
0	$\frac{1}{4}$	0	0
1	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$
2	$\frac{1}{4}$	$\frac{2}{4}$	$\frac{4}{4}$
		$\Sigma xp = 1$	$\Sigma x^2 p = \frac{3}{2}$

Mean $= \Sigma xp = 1$

Variance $= \Sigma x^2 p - (\text{mean})^2$
$$= \frac{3}{2} - 1$$

Variance $= \frac{1}{2}$

Mean and Variance of a Random Variable Ex 32.2 Q15

Out of 13 bulbs 5 are defective $\Rightarrow$ 8 bulbs are good.
3 bulbs are drawn without replacement ,
Let X denote number of defective bulbs,
So, X can have values 0,1,2,3

$$p(X=0) = p(\text{No defective})$$
$$= \frac{8C_3}{13C_3}$$
$$= \frac{8\times7\times6}{13\times12\times11}$$
$$= \frac{28}{143}$$
$$p(X=1) = p(\text{Only one defective})$$
$$= \frac{8C_2\times5C_1}{13C_3}$$
$$= \frac{8\times7\times5}{2}\times\frac{3\times2\times1}{13\times12\times11}$$
$$= \frac{70}{143}$$
$$p(X=2) = p(\text{Only two defective})$$
$$= \frac{8C_1\times5C_2}{13C_3}$$
$$= \frac{8\times5\times4}{2}\times\frac{3\times2\times1}{13\times12\times11}$$
$$= \frac{40}{143}$$
$$p(X=3) = p(\text{all three are defective})$$
$$= \frac{5C_3}{13C_3}$$
$$= \frac{4\times5}{2}\times\frac{3\times2\times1}{13\times12\times11}$$
$$= \frac{5}{143}$$
So, Probability distribution is

X :	0	1	2	3
$p(x)$:	$\frac{28}{143}$	$\frac{70}{143}$	$\frac{40}{143}$	$\frac{5}{143}$

Mean and Variance of a Random Variable Ex 32.2 Q16

$P(\text{win}) = \frac{1}{13} \Rightarrow \qquad P(\text{lose}) = \frac{12}{13}$

He gains Rs 90 if he wins and loses Rs 10 if his number does not appear.

Let X denote total loss or gain, so,

X :	90	-10
$P(x)$:	$\frac{1}{13}$	$\frac{12}{13}$
XP :	$\frac{90}{13}$	$\frac{-120}{13}$

$$E(X) = \Sigma XP$$
$$= \frac{90}{13} - \frac{120}{13}$$
$$E(X) = -\frac{30}{13}$$

Mean and Variance of a Random Variable Ex 32.2 Q17

Let 'X' be the random variable which can assume values from 0 to 3.

$$P(X = 0) = \frac{{}^{26}C_3}{{}^{52}C_3} = \frac{2600}{22100} = \frac{2}{17}$$

$$P(X = 1) = \frac{{}^{26}C_1 \times {}^{26}C_2}{{}^{52}C_3} = \frac{8450}{22100} = \frac{13}{34}$$

$$P(X = 2) = \frac{{}^{26}C_2 \times {}^{26}C_1}{{}^{52}C_3} = \frac{8450}{22100} = \frac{13}{34}$$

$$P(X = 3) = \frac{{}^{26}C_3}{{}^{52}C_3} = \frac{2600}{22100} = \frac{2}{17}$$

Probability distribution of X:

$X = x_i$	0	1	2	3
$p(X = x_i)$	$\frac{2}{17}$	$\frac{13}{34}$	$\frac{13}{34}$	$\frac{2}{17}$

$$\text{Mean} = \sum_{i=0}^{3} (x_i \times p_i)$$
$$= x_0p_0 + x_1p_1 + x_2p_2 + x_3p_3$$
$$= 0 \times \frac{2}{17} + 1 \times \frac{13}{34} + 2 \times \frac{13}{34} + 3 \times \frac{2}{17}$$
$$= \frac{13 + 26 + 12}{34}$$
$$= \frac{51}{34}$$
$$= \frac{3}{2}$$
$$= 1.5$$

Mean and Variance of a Random Variable Ex 32.2 Q18

X can assume values 0, 1, 2.
Yes X is a random variable.

$$P(X = 0) = (\text{Probablity of getting no black ball}) = \frac{{}^2C_0 \times {}^5C_2}{{}^7C_2} = \frac{1 \times \frac{5 \times 4}{2 \times 1}}{\frac{7 \times 6}{2 \times 1}} = \frac{20}{42}$$

$$P(X = 1) = (\text{Probablity of getting one black ball}) = \frac{{}^2C_1 \times {}^5C_1}{{}^7C_2} = \frac{2 \times 5}{\frac{7 \times 6}{2 \times 1}} = \frac{20}{42}$$

$$P(X = 2) = (\text{Probablity of getting two black balls}) = \frac{{}^2C_2 \times {}^5C_0}{{}^7C_2} = \frac{1 \times 1}{\frac{7 \times 6}{2 \times 1}} = \frac{2}{42}$$

Thus, probablity distribution of random veriable X is,

X	0	1	2
P(X)	$\frac{20}{42}$	$\frac{20}{42}$	$\frac{2}{42}$

x_i	p_i	$p_i x_i$	$p_i x_i^2$
0	$\frac{20}{42}$	0	0
1	$\frac{20}{42}$	$\frac{20}{42}$	$\frac{20}{42}$
2	$\frac{2}{42}$	$\frac{4}{42}$	$\frac{8}{42}$
		$\Sigma p_i x_i = \frac{4}{7}$	$\Sigma p_i x_i^2 = \frac{2}{3}$

$$\text{Mean} = \Sigma p_i x_i = \frac{4}{7}$$

$$\text{Variance} = \Sigma p_i x_i^2 - (\Sigma p_i x_i)^2 = \frac{2}{3} - \left(\frac{4}{7}\right)^2 = \frac{50}{147}$$

Mean and Variance of a Random Variable Ex 32.2 Q19

We can select two positive in $6 \times 5 = 30$ different ways.

X denotes tha larger number so, X can assume values 3, 4, 5, 6 and 7.

Yes X is a random variable.

$$P(X = 3) = P(\text{larger number is } 3) = \{(2,3),(3,2)\} = \frac{2}{30}$$

$$P(X = 4) = P(\text{larger number is } 4) = \{(2,4),(4,2),(3,4),(4,3)\} = \frac{4}{30}$$

$$P(X = 5) = P(\text{larger number is } 5) = \{(2,5),(5,2),(3,5),(5,3),(4,5),(5,4)\} = \frac{6}{30}$$

$$P(X = 6) = P(\text{larger number is } 6) = \{(2,6),(6,2),(3,6),(6,3),(4,6),(6,4),(5,6),(6,5)\} = \frac{8}{30}$$

$$P(X = 7) = P(\text{larger number is } 7) = \{(2,7),(7,2),(3,7),(7,3),(4,7),(7,4),(5,7),(7,5),(6,7),(7,6)\} =$$

Thus, probablity distribution of random veriable X is,

x_i	p_i	$p_i x_i$	$p_i x_i^2$
3	$\frac{2}{30}$	$\frac{6}{30}$	$\frac{18}{30}$
4	$\frac{4}{30}$	$\frac{16}{30}$	$\frac{64}{30}$
5	$\frac{6}{30}$	$\frac{30}{30}$	$\frac{150}{30}$
6	$\frac{8}{30}$	$\frac{48}{30}$	$\frac{288}{30}$
7	$\frac{10}{30}$	$\frac{70}{30}$	$\frac{490}{30}$
		$\Sigma p_i x_i = \frac{17}{3}$	$\Sigma p_i x_i^2 = \frac{101}{3}$

$$\text{Mean} = \Sigma p_i x_i = \frac{17}{3}$$

$$\text{Variance} = \Sigma p_i x_i^2 - (\Sigma p_i x_i)^2 = \frac{101}{3} - \left(\frac{17}{3}\right)^2 = \frac{14}{9}$$