

EXERCISE 32.1

Question. 1(i)

Solution:

From the question distribution is given,

$$\begin{array}{l} x : 3 \quad 2 \quad 1 \quad 0 \quad -1 \\ P(x) : 0.3 \quad 0.2 \quad 0.4 \quad 0.1 \quad 0.05 \end{array}$$

Then,

$$\begin{aligned} \text{Sum of probabilities} &= P(x = 3) + P(x = 2) + P(x = 1) + P(x = 0) + P(x = -1) \\ &= 0.3 + 0.2 + 0.4 + 0.1 + 0.05 \\ &= 1.05 \end{aligned}$$

So, $1.05 \neq 1$

Therefore, the given distribution is not a probability distribution.

Question. 1(ii)

Solution:

From the question distribution is given,

$$\begin{array}{l} x : 0 \quad 1 \quad 2 \\ P(x) : 0.6 \quad 0.4 \quad 0.2 \end{array}$$

Then,

$$\begin{aligned} \text{Sum of probabilities} &= P(x = 0) + P(x = 1) + P(x = 2) \\ &= 0.6 + 0.4 + 0.2 \\ &= 1.2 \end{aligned}$$

So, $1.2 \neq 1$

Therefore, the given distribution is not a probability distribution.

Question. 1(iii)

Solution:

From the question distribution is given,

$$\begin{array}{l} x : 0 \quad 1 \quad 2 \quad 3 \quad 4 \\ P(x) : 0.1 \quad 0.5 \quad 0.2 \quad 0.1 \quad 0.1 \end{array}$$

Then,

$$\begin{aligned} \text{Sum of probabilities} &= P(x = 0) + P(x = 1) + P(x = 2) + P(x = 3) + P(x = 4) \\ &= 0.1 + 0.5 + 0.2 + 0.1 + 0.1 \\ &= 1 \end{aligned}$$

So, $1 = 1$

Therefore, the given distribution is a probability distribution.

Question. 1(iv)**Solution:**

From the question distribution is given,

$$\begin{array}{cccc} x : & 0 & 1 & 2 & 3 \\ P(x) : & 0.3 & 0.2 & 0.4 & 0.1 \end{array}$$

Then,

$$\begin{aligned} \text{Sum of probabilities} &= P(x = 0) + P(x = 1) + P(x = 2) + P(x = 3) \\ &= 0.3 + 0.2 + 0.4 + 0.1 \\ &= 1 \end{aligned}$$

So, $1 = 1$

Therefore, the given distribution is a probability distribution.

Question. 2**Solution:**

From the question distribution is given,

$$\begin{array}{cccccc} x : & -2 & -1 & 0 & 1 & 2 & 3 \\ P(x) : & 0.1 & k & 0.2 & 2k & 0.3 & k \end{array}$$

Then, Sum of probabilities

$$[P(x = -2) + P(x = -1) + P(x = 0) + P(x = 1) + P(x = 2) + P(x = 3)] = 1$$

$$0.1 + k + 0.2 + 2k + 0.3 + k = 1$$

$$4k + 0.6 = 1$$

$$4k = 1 - 0.6$$

$$4k = 0.4$$

$$K = 0.4/4$$

$$K = 4/40$$

$$K = 1/10$$

$$K = 0.1$$

Therefore, value of K is 0.1.

Question. 3**Solution:**

From the question distribution is given,

$$\begin{array}{cccccccccc} x : & 0 & 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 \\ P(x) : & a & 3a & 5a & 7a & 9a & 11a & 13a & 15a & 17a \end{array}$$

(i)

Then, Sum of probabilities

$$P(x = 0) + P(x = 1) + P(x = 2) + P(x = 3) + P(x = 4) + P(x = 5) + P(x = 6) + P(x = 7) + P(x = 8) = 1$$

$$a + 3a + 5a + 7a + 9a + 11a + 13a + 15a + 17a = 1$$

$$81a = 1$$

$$a = 1/81$$

Therefore, value of a is 1/81.

(ii) $P(x < 3) = P(0) + P(1) + P(2)$

$$= a + 3a + 5a$$

$$= 9a$$

Now substitute the value of a, we get

$$= 9(1/81)$$

So, $P(x < 3) = 1/9$

$$P(x \geq 3) = 1 - P(x < 3)$$

$$= 1 - 1/9$$

$$= (9 - 1)/9$$

$$= 8/9$$

Then, $P(0 < x < 5) = P(1) + P(2) + P(3) + P(4)$

$$= 3a + 5a + 7a + 9a$$

$$= 24a$$

Substituting the value of a we get,

$$= 24(1/81)$$

$$= 8/27$$

Therefore, $P(0 < x < 5) = 8/27$

Question. 4

Solution:

From the question distribution is given,

x :	0	1	2
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P(x) :	$3c^3$	$4c - 10c^2$	$5c - 1$
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(i) First we have to find the value of c,

Sum of probabilities = $P(x = 0) + P(x = 1) + P(x = 2) = 1$

$$3c^3 + 4c - 10c^2 + 5c - 1 = 1$$

$$3c^3 - 10c^2 + 9c - 1 - 1 = 0$$

$$3c^3 - 10c^2 + 9c - 2 = 0$$

Above terms can be written as,

$$3c^3 - 3c^2 - 7c^2 + 7c + 2c - 2 = 0$$

Take out common in above terms we get,

$$3c^2(c - 1) - 7c(c - 1) + 2(c - 1) = 0$$

$$(c - 1)(3c^2 - 7c + 2) = 0$$

$$(c - 1)(3c^2 - 6c - c + 2) = 0$$

$$(c - 1)(3c(c - 2) - 1(c - 2)) = 0$$

$$(c - 1)(3c - 1)(c - 2) = 0$$

$$C - 1 = 0, 3c - 1 = 0, c - 2 = 0$$

$$C = 1, C = 1/3, C = 2$$

So, it is clear that $c = 1/3$ is possible, because if $c = 1$, or $c = 2$ then $P(2)$ will become negative.

$$\begin{aligned} \text{(ii) Now, } P(x < 2) &= P(0) + P(1) \\ &= 3c^3 + 4c - 10c^2 \\ &= 3(1/3)^3 + 4(1/3) - 10(1/3)^2 \\ &= 3/27 + 4/3 - 10/9 \\ &= 1/9 + 4/3 - 10/9 \\ &= 3/9 \end{aligned}$$

Therefore, value of $P(x < 2)$ is $3/9$.

$$\begin{aligned} \text{(iii) } P(1 < c \leq 2) &= P(2) \\ &= 5c - 1 \end{aligned}$$

Substitute the value of c we get,

$$\begin{aligned} &= 5(1/3) - 1 \\ &= 2/3 \end{aligned}$$

Therefore, the value $P(1 < c \leq 2)$ is $2/3$

Question. 5

Solution:

From the question it is given that,

$$2P(x_1) = 3P(x_2) = P(x_3) = 5P(x_4)$$

So, let us assume $P(x_3) = a$

$$\text{Then, } 2P(x_1) = P(x_3)$$

$$P(x_1) = a/2$$

$$3P(x_2) = P(x_3)$$

$$P(x_2) = a/3$$

$$5P(x_4) = P(x_3)$$

$$P(x_4) = a/5$$

$$\text{So, } P(x_1) + P(x_2) + P(x_3) + P(x_4) = 1$$

$$a/2 + a/3 + a/1 + a/5 = 1$$

LCM of 2, 3, 1 and 5 is 30.

$$(15a + 10a + 30a + 6a)/30 = 1$$

$$61a = 30$$

$$a = 30/61$$

Therefore,

X :	x_1	x_2	x_3	x_4
P(x) :	15/61	10/61	30/61	6/61

