Assignment-6 (Cbse 12 ex 13.2 12)

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May 20, 2022

Abstract

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This document contains the solution to Cbse class 12 ex 13.48

Problem

Question

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	$2k^2$	$7k^2 + k$

Table: Probability Distribution

determine

1. k
2. $P(X < 3)$
3. $P(X > 6)$
4. $P(0 < X < 3)$

Theory

Property required 1

The sum of all the values of $P(X)$ should always sum upto one.

$$\sum_{i=1}^{n} p_i = 1, \text{for } i = 1, 2, 3, ..., n \tag{1}$$

Property required 1

The value of P(X) should always be positive.

$$p_i > 0, \text{for } i = 1, 2, 3, ..., n \tag{2}$$

Solution 1

determining k

with help of Eq(1) , Eq(2) and based on values on Table1 we can write

$$\implies 0 + k + 2k + 2k + 3k + k^2 + 2k^2 + (7k^2 + k) = 1 \quad (3)$$

$$\implies 10k^2 + 9k = 1 \quad (4)$$

$$\implies 10k^2 + 9k - 1 \quad (5)$$

$$\implies (10k - 1)(k + 1) \quad (6)$$

Solution 1

continuation of determining k

So k can have values $\frac{1}{10}$, -1 but we know based on Eq(2) that probability cannot be negative

$\therefore$ the value of k is 0.1

Solution 2

finding value of $P(X < 3)$

$$P(X < 3) = P(X = 0) + P(X = 1) + P(X = 2) \tag{7}$$
$$= 0 + k + 2k \tag{8}$$
$$= 3k \tag{9}$$
$$= 0.3 \tag{10}$$

$\therefore$ the value 0f $P(X < 3)$ is 0.30

Solution 3

finding value of $P(X > 6)$

$$
\begin{aligned}
P(X > 6) &= P(X = 7) && (11)\\
&= 7k^2 + k && (12)\\
&= 7\,(0.1)^2 + 0.1 && (13)\\
&= 0.07 + 0.1 && (14)\\
&= 0.17 && (15)
\end{aligned}
$$

$\therefore$ the value 0f $P(X > 6)$ is 0.17

Solution 4

finding value of $P(0 < X < 3)$

$$P(0 < X < 3) = P(X = 1) + P(X = 2) \tag{16}$$
$$= k + 2k \tag{17}$$
$$= 3k \tag{18}$$
$$= 0.3 \tag{19}$$

$\therefore$ the value 0f $P(0 < X < 3)$ is 0.30