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Changing your Tomorrow

Random variable and its probability distribution

SUBJECT : (MATHEMATICS)
CHAPTER NUMBER: 13
CHAPTER NAME : PROBABILITY

Website: www.odmegroup.org
Email: info@odmps.org
Toll Free: **1800 120 2316**
Sishu Vihar, Infocity Road, Patia, Bhubaneswar- 751024

Random Variable

Random Variable is a real valued function whose domain in the sample space of random experiment,

Example:-

If we toss two coins, then the sample Space S = $\{HH,\ HT,\ TH,\ TT\}$

If X denotes the number of heads obtained, then X is a random variable and for each outcome its value is given as

X(HH) = 2 , X(HT) = 1, X(TH) = 1 and X(TT) = 0

Again,

If Y denotes the number of heads minus the number of tails and for each outcome its value is given as

Y(HH) =2, Y(HT) = 0, X(TH) = 0, and X(TT) = -2

NOTE:

X and Y are two different random variable for same the same sample space.

Discrete random variables:

A random variable that can take only finite or an accountably infinite number of values is called a discrete random variable.

The probability distribution of a random variable:-

If the values of a random variable together with the corresponding probabilities are given, then this description is called a probability distribution of the random variable.

Example:-

Probability distribution when two coins are tossed;
Let X denoted the number of heads occurred then

P (X = 0) = probability of occurrence of zero head = P(TT) = $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$

P (X = 1) = probability of occurrence of one head = P(HT)+ P(TH) = $\frac{1}{2} \times \frac{1}{2} + \frac{1}{2} \times \frac{1}{2} = \frac{1}{2}$

P (X = 2) = probability of occurrence of two heads = P(HH) = $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$

Thus the probability distribution when two coins are tossed is as given below.

X	0	1	2
P(X)	$1/4$	$1/2$	$1/4$

Problem-1

A random variable X has the following probability distribution:

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

Determine

(i) K (ii) P(X < 3) (iii) P(X > 6) (iv) P(0 < X < 3)

Problem-2

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.

Problem- 3

The random variable X has a probability distribution P(X) of the following form, where k is some number:

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

(i) Determine the value of k

(ii) Find $P(X<2), P(X\le 2)\ and\ P(X\ge 2)$

Problem-4

Find the probability distribution of X, the number of heads in two tosses of a coin (or a simultaneous toss of two coins)

Problem- 5

Three cards are drawn from a pack of 52 playing cards. Find the probability distribution of the number of aces.

Problem-6

An urn contains 4 white and 6 red balls. Four balls are drawn at random from the urn. Find the probability distribution of the number of white balls

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Q1. Four bad oranges are mixed accidentally with 16 good oranges. Find the Probability distribution of the number of bad oranges in a draw of two oranges.

Q2. We take 8 identical slips of paper, write the number 0 on one of them, the number 1 on three of the slips, the number 2 on three of the slips and the number 3 on one of the slips. These sleeps are folded, put in a box and thoroughly mixed. One slip is drawn at random from the box. If X is the random variable denoting the number written on the drawn slip, Find the probability distribution of X.

Q3. 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.

THANKING YOU

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