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STA -101W

Part: B

Ans: to the que: NO-4

We know,

A coin has two side. Head (H) and tail (T).

If a coin tossed tree times, the sample spaces are -

$$S = \{HHH, HHT, HTH, HTT, THH, THT, TTH, TTT\}$$

(i)

If a coin tossed three time, number of outcomes is 8.

Exactly two heads = {HHT, HTH, THH}

$$P(\text{Exactly two heads}) = \frac{3}{8}$$

ii

Sample ~~sap~~ spaces of at least two heads -

$\{HHH, HHT, THH, HTH\}$

$P(\text{at least two heads}) = \frac{4}{8} = \frac{1}{2}$

iii

Sample spaces of no head -

$\{TTT\}$

$P(\text{no head}) = \frac{1}{8}$

Ans: to the que: No-5

(a)

(i)

Random variable:

Let S be the sample space of a random experiment, the sample points are, say $s_1, s_2, \dots s_n$ such that $s \in S$. The real value function $X(s) = x$ of x assigned to each sample point is called random variable.

(ii)

Let x be any random variable and $\phi(x)$ be any function of X. Then expectation of $\phi(x)$ is denoted by $E(\phi(x))$ and is defined by -

$$E(\phi(x))$$

$$\sum \phi(x) f(x)$$

(discrete random variable)

$$\int_{-\infty}^{\infty} \phi(x) f(x) dx$$

(continuous random variable)

if $\phi(x) = x$:

mean $\bar{x} = E(x)$ $\xrightarrow{D.R.V}$ $E(x) = \sum x f(x)$

mean $\bar{x} = E(x)$ $\xrightarrow{C.R.V}$ $E(x) = \int_{-\infty}^{\infty} x f(x)\,dx$

if $\phi(x) = (x-\bar{x})^2$:

varience, $\sigma^2 = E(x-\bar{x})^2$

$= E(x^2 - 2x\bar{x} + \bar{x}^2)$

$= E(x^2) - 2\bar{x}E(x) + \bar{x}^2$

$= E(x^2) - 2\bar{x}^2 + \bar{x}^2$ $[E(x) = \bar{x}]$

$= E(x^2) - \bar{x}^2$

$= E(x^2) - [E(x)]^2$

~~Ans: to the que:~~ NO - 6

$\cancel{a}$

Ans: to the que: NO-5

(b)

Let, X be the number of heads. A coin is tossed $n=2$ times in which probability of head is twice as the probability of tail.

Suppose,

the probability of tail $= y$

" " " head $= 2y$

we know that,

$2y+y=1$

$\Rightarrow 3y=1$

$\Rightarrow y=\frac{1}{3}$

$\therefore$ Probability of success, $p=\frac{2}{3}$

" " failure, $q=\frac{1}{3}$

from binomial distribution, the probability function of x is-

$P(X=x) = {}^{n}C_{x} \cdot p^{x} \cdot q^{n-x}$

$$= {}^{2}C_{x} \cdot \left(\frac{2}{3}\right)^{x} \left(\frac{1}{3}\right)^{2-x} \quad ; \; x=0,1,2.$$

Ans :

Ans: to the que: NO - 6

a

The condition that a binomial variate must satisfy are-

1.) Experiment results must be of two types, usually denoted by 'success' S and 'Failure' F.

2) Probability of success is constant for each trial which is denoted by P. The probability of failure of any trial is $q = 1-P$

3) $P(X=x)$ is a probability function if $\sum P(X=x) = 1$

Ans: to the que: NO- 6

(b)

Let x be the binomial variable. The probability distributio of x is -

$$P(X=x) = \binom{n}{x} \cdot p^x . q^{n-x} \quad \dots\dots (i)$$

we know,

Mean of binomial variable x is -

$$E(x) = np$$

Given,

$$\bar{x} = E(x) = 4$$

$$\therefore np = 4 \quad \dots\dots (ii)$$

Again,

Variance of binomial variable x is -

$$\sigma^2 = npq$$

now given,

Standard deviation, $\sigma = \sqrt{3}$

$$\therefore \sqrt{npq} = \sqrt{3}$$

$\Rightarrow npq = 3$

$\Rightarrow q = \frac{3}{np}$

$\therefore q = \frac{3}{4}$ [from (i)]

$\therefore p = 1 - q$

$\Rightarrow p = 1 - \frac{3}{4}$

$\Rightarrow p = \frac{1}{4}$

$\therefore p = \frac{1}{4}$

Substituting value of p in (ii),

$n \times \frac{1}{4} = 4$

$\therefore n = 16$

$\therefore$ The binomial distribution of X is -

$P(X = x) = \binom{16}{x} \cdot \left(\frac{1}{4}\right)^{x} \cdot \left(\frac{3}{4}\right)^{16-x}$

An

Under the following conditions binomial distribution tends to poisson distribution -

1) Number of trials, $n \to \infty$

2) The probability of success p is constant and $p \to 0$

3) The mean of binomial distribution is $np = \lambda$ and it is finite and a real number since,

$$\lambda = np, \quad p = \frac{\lambda}{n} \text{ and } q = 1 - \frac{\lambda}{n}$$