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Poisson distribution :-

The Probability distribution of Poisson random variable "X" representing the no. of outcomes occurring in a given interval of time or specified region.

" OR "

A limiting approximation of the binomial distribution $b(x : n, p)$ when "P", the Probab of success is very small but "n", the no. of trials is very large - that Product $\mu = np$ is of moderate size.

→ If we assume that "n" goes to infinity and "P" approaches to zero in such a way - that $\mu = np$ remains

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Poisson (Distⁿ) Properties :-

- (1) The no. of outcomes occurring in one time interval or specified region of space is independent of the no. that occurs any other disjoint time interval. In this sense Poisson Process has no memory.
- (2) The Probab. that a single outcome will occur during a very short time interval is proportional to the length of the time interval and does not depend upon the no. of outcomes occurring outside this time interval.
- (3) The Probab. that more than one outcome will occur in such a short time interval or fall in a small region is negligible.

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Parameter :-

The Poisson distribution has only one parameter " μ " that is $\mu > 0$

Mean :-

$$E(x) = \mu$$

Variance :-

$$\text{Variance} = \mu$$

Mgf :-

$$\text{Mgf} = e^{\mu(e^t - 1)}$$

Question # 01

Two hundred Passengers have made reservation for an airplane flight. If the Probab. that a passenger who has a reservation will not show up is 0.01, what is the Probability that exactly three will not show up.

$$n = 200$$

$$p = 0.01$$

$$\mu = np = 200 \times 0.01$$

$$\mu = 2$$

$$P(X=3) = p(3; 2) = \frac{2^3 \cdot e^{-2}}{3!}$$

$$= \frac{8 \times 0.1353}{6} \quad \because e^{-2} = \frac{1}{(2.7182)^2}$$

$$= 0.1804$$

constant, then the limiting form of the binomial Probability distribution is :

$$\lim_{\substack{n \rightarrow \infty \\ p \rightarrow 0}} b(x; n, p) = \frac{\mu^x \cdot e^{-\mu}}{x!}$$

where $x = 0, 1, 2, \dots, \infty$

Example's :-

1) A poisson experiment can generate Observation for the random variable "X" representing the no. of Telephone calls recieved Per hour by an office.

2) The number of Person born blind Per year in a Large city.

3) The number of typing error per Page in a book.