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SUBJECT – STATISTICS

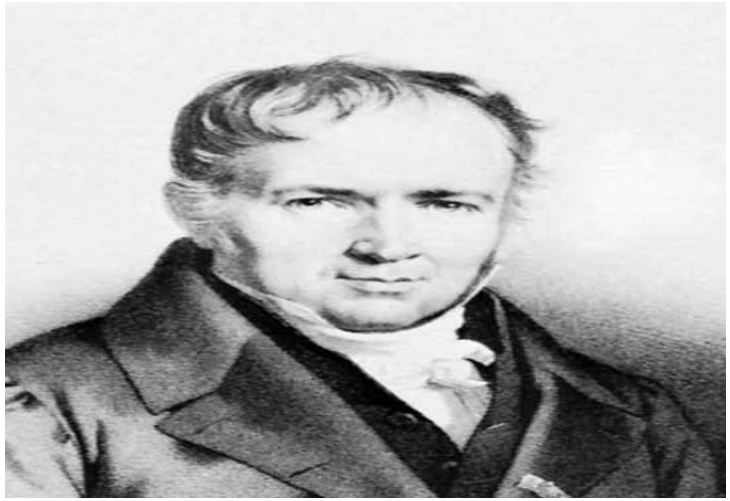
B.SC. PART-II SEMISTER- III

STATISTICS PAPER – V

TOPIC NAME : POISSON DISTRIBUTION

History Of Poisson Distribution

- This distribution was derived French mathematician Simeon Poisson in 1837, and the first application was the description of the number of deaths by horse kicking in the Prussian army(well organized and effective army).



The Poisson Distribution

Poisson Distribution Formula

$$P(x) = \frac{e^{-\lambda} * \lambda^{x}}{x!}$$

Where,

X= 1,2,3,4,5,…….

m= m>0

It is the parameter of poisson distribution.

The mean of poisson distribution i.e the average number of an event

Conditions Under Which Poisson Distribution is used

- The random variable X should be discrete.
- Happening of event must be of two alternatives such as success and failure.
- Events occur independently. In other words , if an event occurs, it does not affect the probability of another event occurring in the same time period

Characteristics of Poisson Distribution:

- Poisson distribution is discrete distribution.
- It depends only on the value of mean.
- The value of lambda is always greater than 0 for the Poisson distribution.
- Poisson distribution has only one parameter.

Why we need Poisson Distribution

- Poisson distribution used in the cases where the chance of any individual event being a success a very small. The distribution is used to describe the behavior of rare events.
- Examples

1) The number of defective screws per box of 5000 screws.
2) The number of printing mistakes in each page of the first proof of book.
3) The number of air accident in india in one year.
4) Occurrence of number of scratches on a sheet of glass.

Solved Examples

Example 1:

In a cafe, the customer arrives at a mean rate of 2 per min. Find the probability of arrival of 5 customers in 1 minute using the Poisson distribution formula.

Solution:

Given: $\lambda = 2$, and $x = 5$.

Using the Poisson distribution formula:

$P(X = x) = (e^{-\lambda} \lambda^{x})/x!$

$P(X = 5) = (e^{-2} 2^{5})/5!$

$P(X = 6) = 0.036$

Answer: The probability of arrival of 5 customers per minute is 3.6%.

Example 2:

Find the mass probability of function at x = 6, if the value of the mean is 3.4.

Solution:

Given: $\lambda = 3.4$, and $x = 6$.

Using the Poisson distribution formula:

$P(X = x) = (e^{-\lambda} \lambda^{x})/x!$

$P(X = 6) = (e^{-3.4} 3.4^{6})/6!$

$P(X = 6) = 0.072$

Answer: The probability of function is 7.2%.


Thank You