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Ref. No.: DBC/BS **Date:** 10 Sept., 2020

B.COM. PART 1

CORE CONCEPT OF BUSINESS MATHMATICS & STATISTICS

POISSON DISTRIBUTION

Named after the French mathematician Simeon Poisson in the year 1837, it was discrete probability distribution. Poisson probabilities are useful when there are a large number of independent trials with a small probability of success on a single trial and the variables occur over a period of time. It can also be used when a density of items is distributed over a given area or volume. It is used to describe the behavior of rare events such as number of germs in one drop of pure water.

Use of Poisson distribution-

1) In insurance Problems to count the number of casualties.
2) In determining the number of deaths due to suicides or rare disease
3) The number of typographical errors per page in a typed material or the number of printing mistakes per page in a book
4) In biology to count the number of bacteria
5) In counting the number of defects per item in statistical quality control
6) Number of accidents taking place per day on a busy road

$$P(x;\lambda) = \frac{e^{-\lambda}\lambda^{x}}{x!}, \quad x = 0, 1, 2, \cdots$$

Lambda in the formula is the mean number of occurrences. If you're approximating a binomial probability using the Poisson, then lambda is the same as mu or n * p.

Example-34:

If there are 500 customers per eight-hour day in a check-out lane, what is the probability that there will be exactly 3 in line during any five-minute period?

Solution- 34:

The expected value during any one five minute period would be 500 / 96 = 5.2083333.

The 96 is because there are 96 five-minute periods in eight hours. So, you expect about 5.2 customers in 5 minutes and want to know the probability of getting exactly 3.

P (3;500/96) = e^(-500/96) * (500/96)^3 / 3! = 0.1288 (approx)

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NORMAL DISTRIBUTION

The normal distribution was first discovered by an English mathematician Abraham De-Moivre in the year 1733, but the credit of its practical application goes to French mathematician Laplace and German astronomer Karl Gauss. It is sometimes also called Gaussian distribution in honour of Gauss.
It is a continuous probability distribution in which the relative frequencies of a continuous variable are distribution according to normal probability law. It is a symmetrical distribution in which the frequencies are distributed evenly about the mean of distribution.

$$p(x, \mu, \sigma) = \frac{1}{\sigma\sqrt{2\pi}} \cdot e^{-\frac{(x-\mu)^2}{2\sigma^2}}$$

Properties of Normal Distribution:

1) Bell-shaped
2) Symmetric about mean
3) Continuous distribution
4) Never touches the x-axis
5) Total area under curve is 1.00
6) Approximately 68% lies within 1 standard deviation of the mean, 95% within 2 standard deviations, and 99.7% within 3 standard deviations of the mean. This is the Empirical Rule mentioned earlier.
7) Data values represented by x which has mean mu and standard deviation sigma.

AREA UNDER THE NORMAL CURVE

The equation of the normal curve depends on mean and standard deviation and for different values of mean and S.D. different normal curves are obtained, for this purpose we use z-transformation, as given below:

$$Z = \frac{x-\bar{x}}{\sigma}$$

Example-35: An aptitude test was conducted on 700 employees of the metro tyres ltd. in which the mean score was found to be 50 units and standard deviation was 20. On the basis of this information, you are required to answer the following questions:

1) What was the number of employees whose mean score was less than 30?
2) What was the number of employees whose mean score exceeded 70?
3) What was the number of employees whose mean score were between 30 and 70?