

Poisson Random Variable

Consider the following random variables:

1. The number of telephone calls received during a fixed period of time.
2. The number of earthquakes occurring during some fixed time span.
3. The number of deaths of policy holders of a life insurance company in a given period of time.
4. The number of α -particles discharged in a fixed period of time from some radioactive material.
5. The number of misprints on a page of a book.

What kind of probability distribution do these random variables have?

Let X = number of occurrences of some phenomenon during a fixed period of time or within a fixed region of space where

- i) the number of occurrences in any two disjoint intervals of time must be independent of each other.
- ii) the probability of an occurrence during any particular short interval of time is proportional to the length of the interval (or area or volume of the region).
- iii) the probability of two or more occurrences is negligible in comparison with the probability of one occurrence.

Then, X has a Poisson distribution.

$$p(k) = \frac{e^{-\lambda} \lambda^k}{k!} \quad \text{for } k = 0, 1, 2, \dots$$