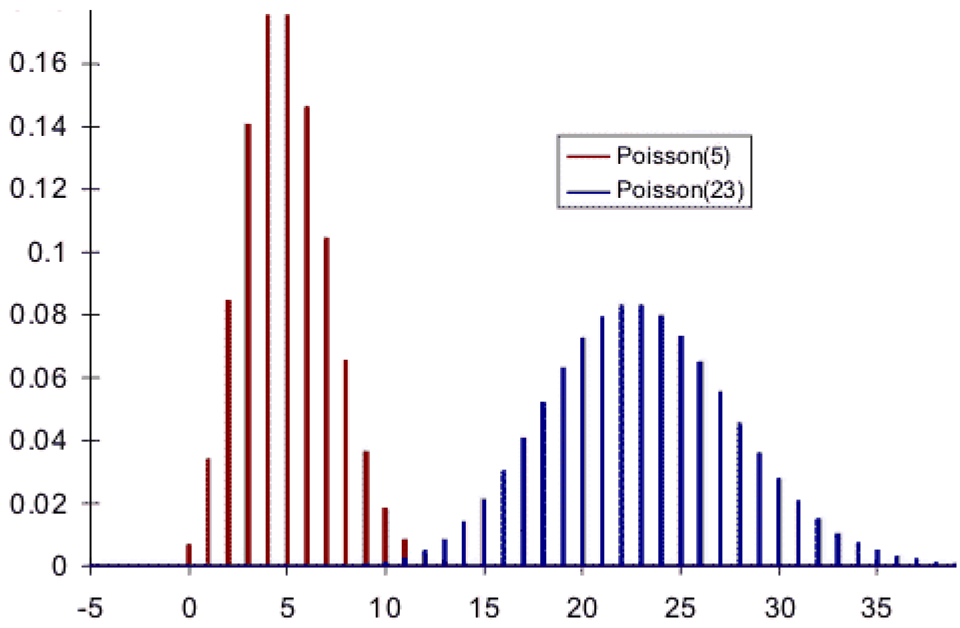
Poisson

Poisson(t)

Poisson equations

In ModelAssist we use the product *t as the parameter for the Poisson distribution, because it makes Poisson modeling much easier. Two examples of the Poisson distribution are shown below, with t equal to 5 and 23 respectively:



Use

The Poisson(*t*) distribution models the number of occurrences of an event in a time t with an expected rate of l events per period t when the time between successive events follows a Poisson process (we suggest that you read the section on the Poisson process first, before continuing here).

Example

If *b* is the mean time between events, as used by the Exponential distribution, then = 1/*b*. For example, imagine that records show that a computer crashes on average once every 250 hours of operation (b=250 hours), then the rate of crashing is 1/250 crashes per hour. Thus a Poisson *(*1000/250*)* = Poisson(4) distribution models the number of crashes that could occur in the next 1000 hours of operation.

Examples in ModelAssist

The Poisson distribution is one of the most important in risk analysis, so you will find a large number of examples. Here are a few:

Time series model of events occurring randomly in time;

Bayesian simulation model to estimate herd infection;

Fire incidence modeling for integrated risk management

Comments

The Poisson distribution has the useful property: Poisson(*a*) + Poisson(*b*) = Poisson(*a*+*b*). This property says in words that if a accidents are expected to happen in some period and b in another period, we could estimate the variability of the total number of accidents in the total period with a Poisson(a + b).

The Poisson distribution is related to the Exponential and Gamma distributions, through the Poisson process. The Poisson distribution and process are named after the French mathematician and physicist *Siméon Denis Poisson*, though *de Moivre* (1711) derived the distribution before Poisson.

The Poisson distribution is often thought incorrectly as being applied only to rare events, perhaps because of the work by *Bortkiewicz*(1898) who looked at the frequency of infantry deaths in the Prussian Army Corps from being kicked by a horse, and who described the scenarios in which the Poisson distribution fits well as the "Law of Small Numbers". Bortkiewicz also fit Poisson distributions to child suicide rates in Prussia. But a rare event applies some subjective idea of what a 'long time' must be and the Poisson mathematics works at all scales of time.

The Excel function POISSON(x,(*t),0) returns the Poisson probability mass function, and POISSON(x,(*t),1) returns the Poisson cumulative distribution function.