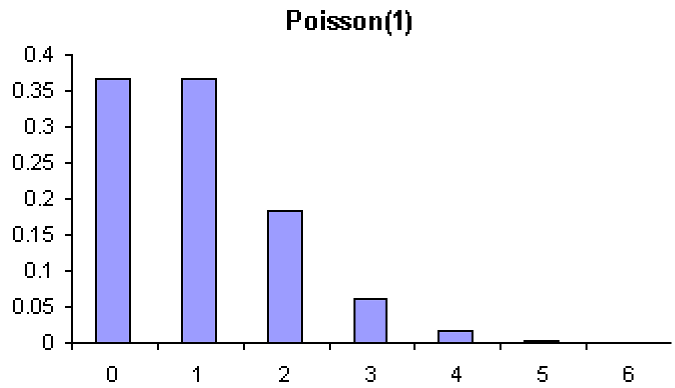
Normal approximation to the Poisson distribution

The Poisson(*lt*) distribution describes the possible number of events that may occur in an exposure of *t* units, where the average number of events per unit of exposure is *l*. A Poisson(*lt*) distribution is thus the sum of *t* independent Poisson(*l*) distributions. We might intuitively guess then that if *lt* is sufficiently large, a Poisson(*lt*) distribution will start to look like a Normal distribution, because of Central Limit Theorem, as is indeed the case. A Poisson(1) distribution (see graph below) is quite skewed, so we would expect to need to add together some 20 or so before the sum would look approximately Normal.



The mean and variance of a Poisson(*lt*) distribution are both equal to *lt*. Thus, the Normal approximation to the Poisson is given by:

Poisson(*lt*) » Normal(*lt*, $(lt)^{1/2}$)

lt > 20

A much more generally useful Normal approximation to the Poisson distribution is given by the formula:

Poisson(*l*) » [Normal($2l^{1/2}$, 1)/2]^2

This formula works for values of *l* as low as 1.

The discrete property of the variable is lost with this approximation. The comments also apply here for retrieving the discreteness and reducing error at the same time that are presented for the Normal approximation to the Binomial.