

# Mixed Poisson process with Stacy mixing variable

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## Abstract

Stacy distribution defined for the first time in 1961 provides a flexible framework for modelling of a wide range of real-life behaviours. It appears under different names in the scientific literature and contains many useful particular cases. Homogeneous Poisson processes are appropriate apriori models for the number of renewals up to a given time  $t > 0$ . This paper mixes them and considers a Mixed Poisson process with Stacy mixing variable. We call it a Poisson-Stacy process. The resulting counting process is one of the Generalised Negative Binomial processes, and the distribution of its time-intersections are very-well investigated in the scientific literature. Here we define and investigate their joint probability distributions. Then, the corresponding mixed renewal process is investigated and Exp-Stacy and Erlang-Stacy distributions are defined and partially studied.

The paper finishes with a simulation study of these stochastic processes. Some plots of the probability density functions, probability mass functions, mean square regressions and sample paths are drawn together with the corresponding code for the simulations.

**Keywords:** Mixed Poisson processes; Stacy distribution; Kratzel integral

**Subject classification codes:** 60G20

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