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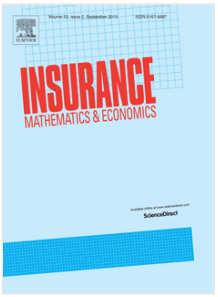

On some compound distributions with Borel summands

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ON SOME COMPOUND DISTRIBUTIONS WITH BOREL SUMMANDS

H. FINNER, P. KERN, AND M. SCHEER

Abstract. The generalized Poisson distribution is well known to be a compound Poisson distribution with Borel summands. As a generalization we present closed formulas for compound Bartlett and Delaporte distributions with Borel summands and a recursive structure for certain compound shifted Delaporte mixtures with Borel summands. Our models are introduced in an actuarial context as claim number distributions and are derived only with probabilistic arguments and elementary combinatorial identities. In the actuarial context related compound distributions are of importance as models for the total size of insurance claims for which we present simple recursion formulas of Panjer type.

1. Introduction

A random variable Z is said to have a compound distribution if it is of the form

$$Z \stackrel{\mathrm{d}}{=} \sum_{k=1}^{N} Y_k,$$

where $(Y_n)_{n\in\mathbb{N}}$ is an i.i.d. sequence and N is an independent random variable with values in $\mathbb{N}_0$. Throughout this paper "$\stackrel{\mathrm{d}}{=}$" denotes equality in distribution and the empty sum $\sum_{k=1}^{0}$ is taken to be zero. The most prominent example is a compound Poisson distribution, where N has a Poisson distribution, which is closely related to infinite divisibility. It is well known that a discrete random variable on $\mathbb{N}_0$ is infinitely divisible if and only if it has a compound Poisson distribution; e.g. see page 290 in [13]. We will focus on compound distributions, where the i.i.d. summands $(Y_n)_{n\in\mathbb{N}}$ have a Borel distribution but the distribution of N can be more general than Poisson.

In fact this note is inspired by some asymptotic distribution results in multiple hypotheses testing. Based on a result by Dempster [10], respectively Finner and Roters [14], the distribution of the number of false rejections in so-called linear step-down (SD) and step-up (SU) procedures under a certain Dirac-uniform configuration,

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