Noncentral Pólya-Aeppli distributions

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In this paper we consider a random variable which is a sum of Poisson distributed and Pólya-Aeppli distributed variables. The resulting distribution is called a noncentral Pólya-Aeppli distribution. The probability mass function, recursion formulas and some properties are derived. Then by trivariate reduction method we introduce a bivariate noncentral Pólya-Aeppli distribution. As application we define the corresponding univariate stochastic process and call it a noncentral Pólya-Aeppli process (NPAP). For the risk model with NPAP counting process we consider the joint distribution of the time to ruin and deficit at the time of ruin. The differential equation of the ruin probability is given. As example we consider the case of exponentially distributed claims.