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Compound binomial approximations

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Abstract We consider the approximation of the convolution product of not necessarily identical probability distributions $q_j I + p_j F$, $(j = 1, \ldots, n)$, where, for all j, $p_j = 1 - q_j \in [0, 1]$, I is the Dirac measure at point zero, and F is a probability distribution on the real line. As an approximation, we use a compound binomial distribution, which is defined in a one-parametric way: the number of trials remains the same but the p_j are replaced with their mean or, more generally, with an arbitrary success probability p. We also consider approximations by finite signed measures derived from an expansion based on Krawtchouk polynomials. Bounds for the approximation error in different metrics are presented. If F is a symmetric distribution about zero or a suitably shifted distribution, the bounds have a better order than in the case of a general F. Asymptotic sharp bounds are given in the case, when F is symmetric and concentrated on two points.

Keywords Compound binomial distribution · Kolmogorov norm · Krawtchouk expansion · Concentration norm · One-parametric approximation · Sharp constants · Shifted distributions · Symmetric distributions · Total variation norm