

A generalized Sibuya distribution

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Abstract The Sibuya distribution arises as the distribution of the waiting time for the first success in Bernoulli trials, where the probabilities of success are inversely proportional to the number of a trial. We study a generalization that can be viewed as the distribution of the excess random variable $N - k$ given $N > k$, where N has the Sibuya distribution and k is an integer. We summarize basic facts regarding this distribution and provide several new results and characterizations, shedding more light on its origin and possible applications. In particular, we emphasize the role Sibuya distribution plays in the extreme value theory and point out its invariance property with respect to random thinning operation.

Keywords Discrete Pareto distribution · Distribution theory · Extreme value theory · Infinite divisibility · Mixed Poisson process · Power law · Pure death process · Records · Yule distribution · Zipf's law

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