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Exact and Approximate Distributions for the Linear Combination of Inverted Dirichlet Components

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Abstract: It is well known that $X + Y$ has the F distribution when X and Y follow the inverted Dirichlet distribution. In this paper, we derive the exact distribution of the general form $\alpha X + \beta Y$ (involving the Gauss hypergeometric function) and the corresponding moment properties. We also propose approximations and discuss evidence of their robustness based on the powerful Kolmogorov-Smirnov test. The work is motivated by real-life examples in quality and reliability engineering.

Key words: Dirichlet distribution, Gauss hypergeometric function, linear combinations of random variables

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