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Simulating random variables with Lindley or Poisson–Lindley distribution

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SUMMARY

We provide algorithms to generate random variables with Lindley, Poisson–Lindley, or zero-truncated Poisson–Lindley distributions. Our procedures are based on the fact that the quantile functions of these probability distributions can be expressed in closed form in terms of the so-called negative branch of the Lambert W function. We recall that the Lambert W function is a multivalued complex function defined as the solution to the equation $W(z)\exp(W(z)) = z$, where z is a complex number; the real branch taking on values in $(-\infty, -1]$ is called the negative branch.

Our methods are more efficient than the algorithms proposed by Ghitany and Al-Mutairi [1] and Ghitany et al. [2, 3]. More precisely, our algorithms reduce the execution time approximately 20% in the cases of Lindley distributions and more than 250% in the cases of Poisson–Lindley distributions (cf. Jodrá [4] for more details).

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