

ORIGINAL PAPER

## Maxima of Gamma random variables and other Weibull-like distributions and the Lambert *W* function

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Abstract In some applied problems of signal processing, the maximum of a sample of  $\chi^2(m)$  random variables is computed and compared with a threshold to assess certain properties. It is well known that this maximum, conveniently normalized, converges in law to a Gumbel random variable; however, numerical and simulation studies show that the norming constants that are usually suggested are inaccurate for moderate or even large sample sizes. In this paper, we propose, for Gamma laws (in particular, for a  $\chi^2(m)$  law) and other Weibull-like distributions, other norming constants computed with the asymptotics of the Lambert *W* function that significantly improve the accuracy of the approximation to the Gumbel law.

**Keywords** Weibull-like distributions  $\cdot$  Gamma distributions  $\cdot$  Extreme value theory  $\cdot$  Lambert function

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