



On the estimation of the shape parameter of the Topp-Leone Distribution

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Abstract

In this paper, we describe and present results on the parameter estimation for the Topp-Leone distribution. Three estimating methods have been investigated, namely, the maximum likelihood method, the method of moments and the probability weighted moments method. A simulation study has shown that the maximum likelihood estimator outperforms the estimators obtained by other methods.

Keywords: Maximum likelihood estimation, Probability weighted moment method, Simulation

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1 Introduction

The Topp-Leone distribution is a univariate continuous two parameter distribution with bounded support which was first proposed and used as a model for some failure data by [2]. Reference [1] provided a motivation for this distribution based on its hazard rate function and then studied the moments and some other main properties of the Topp-Leone distribution. The random variable X with the range $(0, 1)$ has one-parameter Topp-Leone distribution if its probability density function (pdf) can be stated as

$$f(x; \nu) = 2\nu(1-x)x^{\nu-1}(2-x)^{\nu-1}, \quad 0 < x < 1, \quad \nu > 0, \quad (1)$$

and we write $X \sim TL(\nu)$. The corresponding cumulative distribution function (cdf) is given by

$$F(x; \nu) = [x(2-x)]^\nu, \quad 0 < x < 1. \quad (2)$$

Moreover, the quantile function of the Topp-Leone distribution is

$$Q(u) = 1 - \sqrt{1 - u^{\frac{1}{\nu}}}, \quad 0 < u < 1. \quad (3)$$

In what follows, we investigate the estimation of the shape parameter of the Topp-Leone distribution with pdf (1) using the maximum likelihood (ML) method, the method of moments and the probability weighted moments (PWM) method. We also provide a simulation study to compare the mentioned methods numerically.

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