Length-Biased Weighted Lomax Distribution: Statistical Properties and Application

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Abstract

The concept of length-biased distribution can be employed in development of proper models for lifetime data. Length-biased distribution is a special case of the more general form known as weighted distribution. In this paper we introduce a new class of length-biased weighted Lomax distribution, (LBWLD). The statistical properties of this distribution are derived and the model parameters are estimated by maximum likelihood estimation and the observed information matrix is determined. An application to real data set is finally presented for illustration.

Keywords: Weighted distribution, Lomax distribution, Reliability Analysis, Maximum likelihood estimation, Order statistics, Real life data.

1. Introduction

The Lomax distribution also known as Pareto distribution of second kind has, in recent years, assumed opposition of importance in the field of life testing because of its uses to fit business failure data. Lomax distribution was introduced by Lomax (1974), Abdullah and Abdullah (2012) estimates the parameters of Lomax distribution based on generalized probability weighted moment. The Lomax distribution has been used in the literature in a number of ways. For example, it has been extensively used for reliability modeling and life testing; see, for example, Balkema and de Haan (1974). It also has been used as an alternative to the exponential distribution when the data are heavy tailed; see Bryson (1974). Ahsanullah (1991) studied the record values of Lomax distribution. Balakrishnan and Ahsanullah (1994) introduced some recurrence relations between the moments of record values from Lomax distribution. Also, the Lomax model has been studied, from a Bayesian point of view, by many authors; Nasiri and Hosseini (2012), Afaq et al. (2014) estimates the parameters of Lomax distribution using Jeffery's and extension of Jeffery's prior under different loss functions. The probability density function (pdf) of the Lomax distribution (LD) is given by

$$f(x;\theta,\lambda)=\frac{\theta}{\lambda}\left(1+\frac{x}{\lambda}\right)^{-(\theta+1)} \quad ; \quad x>0,\theta,\lambda>0 \tag{1}$$