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Original article

Predicting future lifetime based on random number of three parameters Weibull distribution

Magdy E. El-Adll

Department of Mathematics, Faculty of Science, Helwan University, Ain Helwan, Cairo, Egypt

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Abstract

In this paper, two pivotal quantities are modified to construct prediction intervals for future lifetime based on random number of three parameters Weibull distribution, which can be widely applied in reliability theory and lifetime problems. The case of fixed sample size is presented as a special case. The random number has one of three important distributions as special cases. An algorithm is constructed to explain the importance of the theoretical results in applications. Simulation studies are conducted to investigate the efficiency of the purposed results. Finally, two numerical examples for real lifetime data are presented to illustrate the paper.

AMS Classification: Primary 60F05; 62E20; Secondary 62E15; 62G30

Keywords: Order statistics; Truncated distributions; Predicative interval; Probability coverage; Monte Carlo simulation

1. Introduction

There are three main problems in statistical inference, the first is to fit real data to a specific statistical model, the second is to estimate the unknown model parameters and the third is to give methods for predicting future observations based on this model. In many practical applications such as biological science, physics, engineering and manufacture, the available data can be interpreted as lifetimes and it is important to predict future observations. In the theory and methods as well as in various fields of applied statistics, the Weibull distribution has been steadily growing for more than half a century. Moreover, Weibull distribution without any doubt is one of the most important models in modern statistics because of its ability to fit data from various fields, ranging from life data to weather data or observations made in economics and business administration, in hydrology, in biology or in the engineering sciences.

A commonly used model in reliability theory and lifetime studies is the three-parameters Weibull distribution, which was introduced by the Swedish statistician Waloddi Weibull and used for the first time in 1939 in connection with his studies on the strength of materials. For more details and applications of Weibull distribution see Rinne [14].

E-mail address: meladll2@yahoo.com

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