Available online at www.sciencedirect.com

SciVerse ScienceDirect

Mathematics and Computers in Simulation 82 (2012) 1383–1395

MATHEMATICS AND COMPUTERS IN SIMULATION

www.elsevier.com/locate/matcom

Original article

Reliability analysis based on progressively first-failure-censored samples for the proportional hazard rate model

Liang Wang *, Yimin Shi

Department of Applied Mathematics, Northwestern Polytechnical University, Xi'an 710072, PR China

Received 21 July 2010; received in revised form 7 September 2011; accepted 7 December 2011
Available online 28 January 2012

Abstract

Based on a new life test plan called a progressive first-failure-censoring scheme, the estimation problem of the reliability performances is considered for a semi-parameter class of distributions by using Bayes and non-Bayes methods. In order to investigate the accuracy of estimation, an illustrative example is examined numerically by means of Monte-Carlo simulation.

Keywords: Bayes estimation; Asymmetric loss function; Progressive first-failure-censoring; Monte-Carlo simulation

1. Introduction and notation

Censoring life test is very common in many reliability experiments and lifetime studies. Generally speaking, censoring implies that exact failure times are known for only a portion of the units under study. Meanwhile, the censoring mechanism, which cannot be ignored, plays an important role in determining how the reliability data should be analyzed. Detailed reviews about the censoring mechanisms encountered in reliability work can be found in [9]. There are several types of censoring tests, and the most common ones are Type-I censoring and Type-II censoring, where n units are subjected to some forms of test and the experiment is terminated after a fixed time or exactly $m(<n)$ units fail. However, in modern industry, the product features high lifetime and high test cost, in order to take a more efficient way to get failure samples and to improve the efficiency of inference procedures in lifetime studies than those under conventional censoring schemes, based on conventional censoring mechanism, progressive censoring test was introduced in practice, namely progressive Type-I and Type-II censoring, as well as progressive random censoring et al. The property of progressive censoring with different lifetime distribution has been studied extensively by several authors including [2,14,17]. For more information about progressive censoring, we refer to see [3], and the reference therein.

It is known that progressive censoring tests have a significant improvement in the efficiency of inference procedures as compared to these derived under the conventional methods of censoring in reliability experiment. Sometimes the lifetime of products, however, are very high, and the experimental time of a censoring life test can be still too long. In order to give an efficient experiment, statistician and practitioner introduced other test methods, and one of them is called first-failure censoring scheme, introduced by [8] and further illustrated by [5], in which the experimenter can test $m \times n$ units by testing m groups, each containing n units, and then run all the test units simultaneously until the

* Corresponding author.
E-mail address: liang610112@gmail.com (L. Wang).

0378-4754/$36.00
doi:10.1016/j.matcom.2011.12.004