STATISTICAL INFERENCES ON SOME GENERALISED RELIABILITY MODELS

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ABSTRACT OF THE THESIS

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ABSTRACT

The present thesis contains six chapters, which are briefly discussed below.

Chapter-1 is completely introductory explaining the basic concepts of reliability theory with their inception. Some well-known distributions along with their applications have been discussed. Various techniques of the extension of lifetime distributions are given. An overview of different priors, loss functions and censoring schemes is provided. At the end of the chapter, brief review of the literature in the related areas is also listed.

In Chapter-2, we propose the Exponentiated Perks distribution as a generalization of Perks distribution. We study its mathematical properties. The maximum likelihood estimates along with their standard errors and confidence intervals of the parameters have been obtained. Bayes estimates are obtained using independent gamma priors. The posterior densities are simulated using Metropolis-Hastings algorithm to obtain sample-based estimates and highest posterior density intervals. Applications of the proposed distribution to three real data sets have been demonstrated.

In Chapter-3, we introduce an extended version of the modified Weibull distribution, which contains various sub-models. We study its statistical properties .The parameters are estimated by using maximum likelihood and Bayesian methods. In Bayesian estimation, we assume independent gamma priors for the parameters and MCMC technique has been implemented to obtain the estimates and the highest posterior density intervals of the parameters. Tierney and Kadane's approximation procedure is also used to obtain Bayes estimates. To highlight the importance of various estimates obtained, a simulation study is carried out. The usefulness of the proposed model is illustrated using two real datasets.

Chapter- 4 deals with the estimation of load-share parameters with Type-I and Type-II failure censored data considering Weibull distribution. The maximum likelihood and bootstrap estimates, system reliability and hazard rate functions along with estimated errors are obtained. Classical, boot-p and boot-t confidence intervals for the model parameters have been constructed. Assuming informative priors, Bayes estimates and highest posterior density intervals of the reliability parameters are also computed using MCMC methods under symmetric and asymmetric loss functions. To compare the efficiency of the estimates, a simulation study is carried out. Two real dataset analysis is shown to illustrate the applications of the proposed model.

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Chapter -5, addresses the problem of parameter estimation of a k-component load-sharing redundant system model using components' failure data under Type-II censoring scheme. The underlying failure rate of each factor is taken to have bathtub shape. In the traditional configuration, we obtain MLEs and asymptotic confidence intervals for the load-sharing parameters, while Bayesian estimates are obtained under symmetric and asymmetric loss functions by assuming a joint Dirichlet distribution of unknown parameters. A simulation study is performed to compare the various estimation methods digitally.

The study in Chapter-6 deals with the estimation of reliability $R = P[Y < X < Z]$, where the random variables X, Y and Z are assumed to be independent and follow Weibull distribution with different scales and common shape parameters. The classical and Bayesian estimation of the stress-strength reliability R have been done under progressive Type-II censoring scheme. In classical setup, we obtain MLE's and UMVUE of R. Further, assuming independent gamma priors for the unknown parameters, Bayes estimate of R under squared error loss function is derived. The biases and mean square errors are used to compare the performances of the proposed estimators. One real data analysis has been performed for illustrative purpose.

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