ABSTRACT

This thesis deals with the problem of classification of an observation into one of two/several normal, exponential or gamma populations when additional information on the parameters is available in the form of equality or order restrictions.

In **Chapter 1**, we give a brief introduction to the general problem of classification. A detailed review of the existing literature on the problems of classification, problem of classification under order restrictions and on the problem of estimation under restrictions is given.

In **Chapter 2**, some basic notations and terminology for the problems of classification and estimation are given.

In **Chapter 3**, we investigate the problem of classification of an observation into one of two univariate normal distributions with a common unknown mean but different variances. The case of ordered variances is also considered. We also propose rules for classifying an observation into several normal populations under ordering among variances.

Chapter 4 presents two-parameter exponential distributions with a common location parameter but different unknown scale parameters where the scale parameters are ordered. When the location parameter is known, classification of an observation into two exponential populations is studied assuming the population means are ordered. When the location parameter is unknown, we derive UMVUEs, equivariant estimators, mixed estimators, Bayes estimators of the ordered scale parameters. The problem of classification for this model has also been studied using the proposed estimators. Likelihood ratio-based classification rules are proposed. This study is further extended to the problem of classification into one of k (≥ 3) exponential populations with a common location and ordered scale parameters. The performance of various classification rules has been compared with respect to the expected probability of correct classification (EPC) using simulations.

Chapter 5 deals with the problem of classification of an observation into two-parameter exponential populations with different unknown scale parameters and location parameters. We propose classification rules when either location or scale parameters are ordered. Some of these classification rules under ordering are better than usual classification rules with respect to the EPC. We also derive likelihood ratio-based classification rules. Comparison of these classification rules has been done using Monte Carlo simulations.

In **Chapter 6**, we study the problems of estimation and classification into two Gamma populations with ordered scale parameters and known shape parameters. We derive estimators of linear functions of the scale parameters. A class of estimators improving upon the restricted MLEs with respect to the squared error loss function is obtained. An inadmissibility result for estimating the linear function of the reciprocal of the scale parameters is also established. The proposed estimators are applied to the problem of classification of an observation into two gamma populations.

Keywords: Anderson's classification rule, Bayes estimator, Best affine equivariant estimator, Best scale equivariant estimator, Classification rule, Common mean, Expected probability of correct classification, Exponential population, Mixed estimator, Ordered parameters, Problem of classification, Probability of misclassification, Maximum likelihood estimator, Likelihood ratio, Uniformly minimum variance unbiased estimator, Restricted maximum likelihood estimator.