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Simultaneous confidence procedures for multiple comparisons of mean vectors in multivariate normal populations

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0. Introduction

The study of the subjects of multiple comparisons under univariate and multivariate statistical analyses has been done by many authors. Reviews on some aspects of multiple comparison procedure have been given in Miller [22]. We refer to Miller [23, 24], Hochberg & Tamhane [11], etc. for the univariate case and to Roy & Bose [27], Krishnaiah & Reising [20] and Krishnaiah [18, 19], and so on for the multivariate case. This paper is concerned with multiple comparisons of correlated mean vectors under the multivariate normal populations. One of the important problems is to construct the simultaneous confidence intervals for the multivariate multiple comparisons with the given simultaneous confidence level in unbalanced models. In multivariate setting, however, it is difficult to find the exact simultaneous confidence intervals even in balanced models. In order to respond to the problem, we discuss the approximation procedures to obtain the good approximate simultaneous confidence intervals. We also discuss the approximation to the simultaneous confidence intervals in a GMANOVA model which is a useful basis in the analysis of data on growth curve. First, in order to achieve the purpose, it is necessary to find the upper percentiles of the key statistics which play an important role in constructing the simultaneous confidence intervals. This is what is called the generalized $T^2_{\max}$-type statistic. In Section 1, the approximate upper percentiles of the statistics are given for multiple comparisons among pairwise treatments and for comparisons among treatments with a control, respectively, and the accuracy of the estimated percentiles is investigted by Monte Carlo simulations. On the approximate procedure, we adopt the modified second approximation procedure which have been referred to Siotani [32, 33], Seo & Siotani [29]. The modified second approximation procedure based on Bonferroni's inequalities offers an attractive and an intuitive approach to produce fairly accurate approximations, though the accuracy of the approximations depends on parameters. Further, in Section 2, the approximate simultaneous confidence intervals for multiple comparisons among the components of treatment vectors are discussed. In Section 3, we consider a