SIMULTANEOUS ESTIMATION OF MEANS OF CLASSIFIED NORMAL OBSERVATIONS

TOYOAKI AKAI

*Department of Mathematics, Faculty of Science and Technology, Keio University,
Yokohama 223, Japan*

Abstract. Simultaneous estimation of normal means is considered for observations which are classified into several groups. In a one-way classification case, it is shown that an adaptive shrinkage estimator dominates a Stein-type estimator which shrinks observations towards individual class averages as Stein's (1966, *Festschrift for J. Neyman*, (ed. F. N. David), 351–366, Wiley, New York) does, and is minimax even if class sizes are small. Simulation results under quadratic loss show that it is slightly better than Stein's (1966) if between variances are larger than within ones. Further this estimator is shown to improve on Stein's (1966) with respect to the Bayes risk. Our estimator is derived by assuming the means to have a one-way classification structure, consisting of three random terms of grand mean, class mean and residual. This technique can be applied to the case where observations are classified into a two-stage hierarchy.