

Solomon W. Harrar · Arjun K. Gupta

Asymptotic expansion for the null distribution of the F -statistic in one-way ANOVA under non-normality

Received: 9 February 2004 /

Published online: 17 June 2006

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Abstract In this paper we derive the asymptotic expansion of the null distribution of the F -statistic in one-way ANOVA under non-normality. The asymptotic framework is when the number of treatments is moderate but sample size per treatment (replication size) is small. This kind of asymptotics will be relevant, for example, to agricultural screening trials where large number of cultivars are compared with few replications per cultivar. There is also a huge potential for the application of this kind of asymptotics in microarray experiments. Based on the asymptotic expansion we will devise a transformation that speeds up the convergence to the limiting distribution. The results indicate that the approximation based on limiting distribution are unsatisfactory unless number of treatments is very large. Our numerical investigations reveal that our asymptotic expansion performs better than other methods in the literature when there is skewness in the data or even when the data comes from a symmetric distribution with heavy tails.

Keywords Analysis of variance, Edgeworth expansion, Cumulants, Characteristic function, Asymptotic expansion, Non-normality