FINITE POPULATION CORRECTIONS FOR RANKED SET SAMPLING

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Abstract. Ranked set sampling (RSS) for estimating a population mean μ is studied when sampling is without replacement from a completely general finite population $\boldsymbol{x} = (x_1, x_2, \ldots, x_N)'$. Explicit expressions are obtained for the variance of the RSS estimator $\hat{\mu}_{\mathrm{RSS}}$ and for its precision relative to that of simple random sampling without replacement. The critical term in these expressions involves a quantity $\gamma = (\boldsymbol{x} - \mu)'\boldsymbol{\Gamma}(\boldsymbol{x} - \mu)$ where $\boldsymbol{\Gamma}$ is an $N \times N$ matrix whose entries are functions of the population size N and the set-size m, but where $\boldsymbol{\Gamma}$ does not depend on the population values $\boldsymbol{x}$. A computer program is given to calculate $\boldsymbol{\Gamma}$ for arbitrary N and m. When the population follows a linear (resp., quadratic) trend, then γ is a polynomial in N of degree $2m + 2$ (resp., $2m + 4$). The coefficients of these polynomials are evaluated to yield explicit expressions for the variance and the relative precision of $\hat{\mu}_{\mathrm{RSS}}$ for these populations. Unlike the case of sampling from an infinite population, here the relative precision depends upon the number of replications of the set size m.

Key words and phrases: Linear range, observational economy, order statistics from finite populations, quadratic range, relative savings, sampling efficiency, sampling from finite populations, sampling without replacement.