

AN OVERVIEW OF SOME CONCEPTS FOR POTENTIAL USE IN RANKING POPULATIONS BASED ON SAMPLE SURVEY DATA

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Abstract

Assume k populations with associated respective real-valued parameters $\theta_1, \theta_2, \dots, \theta_k$. While the values of $\theta_1, \theta_2, \dots, \theta_k$ are unknown, it is desired to rank the k populations from smallest to largest based on these unknown values. If the statistic $\hat{\theta}_i$ is an estimator of θ_i for $i = 1, 2, 3, \dots, k$ based on sample survey data, it is a common practice to rank the k populations based on the ranking of the observed values, $\hat{\theta}_1, \hat{\theta}_2, \dots, \hat{\theta}_k$, that is,

$$\hat{\theta}_{(1)} \leq \hat{\theta}_{(2)} \leq \dots \leq \hat{\theta}_{(i)} \leq \dots \leq \hat{\theta}_{(k)}.$$

For example, the U. S. Census Bureau's American Community Survey (ACS) produced 85 different rankings of the $k = 51$ states (actually 50 states and Washington, D.C.) based on observed sample estimates during 2011. One of those rankings ranks the states based on $\hat{\theta}_i$ the estimated mean travel time to work for workers 16 years and over who did not work at home (minutes) for state i where $i = 1, 2, 3, \dots, 51$. Because rankings based on the observed values of the statistics $\hat{\theta}_1, \hat{\theta}_2, \dots, \hat{\theta}_k$ can vary depending on the variability in the observed samples, some statement of uncertainty should accompany the presentation of each reported ranking. Assuming that a nation's official statistics should be *widely understood* and *robust*, this paper reports concepts and empirical results of some methods for stating uncertainty in rankings using ACS data. Beginning with pair-wise comparisons, we limit our focus to some practices, assisted by visualizations, found in the literature from classical central limit theorem based as well as classical nonparametric methods. Our focus includes procedures based on the well-known Wilcoxon-Mann-Whitney Rank Sum Test, a generalization of this test, and the bootstrap (nonparametric/parametric). We also refer to concepts and methods from the ranking and selection literature.

KEYWORDS: Nonparametrics, Official statistics, Uncertainty in rankings.

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