Statistical Consulting Center
Department of Statistics – Franklin College of Arts and Sciences
UNIVERSITY OF GEORGIA

SCC Seminar on Data Analysis

Multiple Comparisons & Simultaneous Inference
Methods and Advice

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The statistical analysis of data from a study, or from related studies that are part of a single research project, typically involves several statistical hypothesis tests and confidence intervals. Standard methods of statistical inference ensure each test has a given probability of incorrectly rejecting the null hypothesis (the Type I error rate, often set at 5%) and that each interval has a coverage probability controlled at a chosen level (e.g., 95%). But when we conduct many inferences, the chance that we make at least one Type I error among all of our tests and confidence intervals is typically much larger than the one-at-a-time error rate. This issue is well known. In the context of comparing estimates of population means, it is called the multiple comparisons problem, and multiple comparison procedures (e.g., Tukey's HSD method, Dunnett's method, etc.) are familiar to most ANOVA users. But the problem of simultaneous inference arises more broadly. When we analyze multiple response variables from the same study, should we adjust for multiplicity? In a regression context, we may conduct significance tests on many potential covariates to select the model; should we adjust for multiplicity? How about if we follow up a significant test of an A*B interaction with tests of effect slices for A at each level of B?

I will review the basics of the simultaneous inference problem and discuss some contexts where it arises. I will describe some of the standard multiple comparison procedures in the ANOVA context where those methods are most commonly applied. We will see that there is considerable controversy and inconsistency about how, when, and even whether to adjust for multiplicity, especially when we move out of the framework of ANOVA models for experimental data. I will make some suggestions for how to deal with multiplicity in several different contexts, but with the caveat that some aspects of the problem are non-statistical and inherently subjective.

Monday, October 31, 2022, 4:00pm-5:00pm

ROOM 109, Sanford Hall

About the SCC Seminar Series: This series of non-technical talks, sponsored by the UGA Statistical Consulting Center, aims to present topics of interest to statisticians and users of statistics related to the practical use of statistics for data analysis.

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