School of Mathematical and Statistical Sciences
Arizona State University

M E M O R A N D U M

DATE: 05/14/2024

TO: Faculty and Students

FROM: Professor Yi Zheng, Chair of Zhicui Zhang

Committee Members
Jeffrey Wilson
Mark Reiser
Shiwei Lan
Shuang Zhou

RE: Zhicui Zhang, Defense for the PhD in Statistics

DEFENSE ANNOUNCEMENT

Candidate: Zhicui Zhang

Defense Date: Monday, 06/03/2024

Time: 12:00 PM

Location: WXLR A206

Link: https://asu.zoom.us/j/8338639985

Title: Variation of Restricted Optimal Item Calibration for Computerized Adaptive Test

Please share this information with colleagues and other students, especially those studying in similar fields. Faculty and students are encouraged to attend. The defending candidate will give a 40-minute talk, after which the committee members will ask questions. There may be time for questions from those in attendance. Guests are primarily invited to attend as observers and will be excused when the committee begins its deliberations or if the committee wishes to question the candidate privately.

ABSTRACT

Item calibration is the process of estimating the parameters of test items or questions when item response theory (IRT) is used to analyze test response data, provide a score for each test-taker, and/or facilitate computerized adaptive testing (CAT). CAT is a modern technology for test administration where test items are selected on the fly for each examinee to tailor the test individually. The adaptive item selection algorithms in CAT depend on known item parameters. Hence item calibration is a critical component in CAT operations. The statistical process of estimating item parameters depends on observed data generated by examinees responding to the items. The most basic way to obtain response data for item calibration is by conducting a standalone pretesting event where test-takers are recruited to take the test solely for the purpose of collecting data for item calibration. Because that process can be costly and time-consuming, online calibration techniques are invented to insert several pretest items in a live test, so that response data are collected on the go. Given a pool of pretest items to be calibrated, different approaches have been proposed to select pretest items for each examinee, such as random selection, examine-centered selection, and various item-centered selection methods. A common goal of most pretest item selection approaches is to optimize the efficiency of the statistical estimation of the item parameters. Hence the theories and techniques of optimal design in statistics have been applied and extended for this application. Optimal design, in general, involves identifying the most important variables that influence the outcome of the experiment, and determining the optimal values of these factors that provides the most information for estimating statistical model parameters. The main focus of this thesis is applying, extending, and evaluating variations of optimal restricted design for online calibration for the 2-parameter logistic model. A simulation study is conducted to compare the existing methods with variations of restricted optimal design using different criteria.