

University of Maryland, College Park
EDMS 724: Modern Measurement Theory
Spring 2022
Class Location: EDU (Benjamin Bldg) 3236
Class Meeting Time: Wednesday 4:15-7:00pm

Instructor

Yang Liu

Email: yliu87@umd.edu

Virtual Office Hours: Wednesday 1:30–3:30pm, or by appointment

Zoom Link: <https://umd.zoom.us/j/7149027904>

Course Description

A central theme in psychological and educational measurement is the establishment of technical criteria and statistical models for ensuring the reliability and validity of the measurement instruments (e.g., standardized tests, survey questionnaires, etc.). In modern psychometrics, item response theory (IRT) refers to latent variable measurement models for categorical response data together with the associated procedures for statistical inference. IRT has become the state-of-the-art method for item analysis, test assembly, and scoring.

EDMS 724 is a graduate level course on IRT, covering the basics of unidimensional IRT models, test scoring, parameter estimation, model fit assessment, and applications. The course materials were developed in collaboration with Dr. Ji Seung Yang. The course starts with a brief review on the history of IRT. IRT models for various item responses (e.g., dichotomously and polytomously scored item responses) are then presented with empirical/simulated data examples. Point and interval estimation of model parameters and scale scores are introduced from both Bayesian and frequentist perspectives. Brief discussions on advanced topics such as item/person fit assessment, differential item functioning, and linking are provided in preparation for higher-level seminar courses. Overall, this course focuses on the statistical theory underlying IRT models, as well as their application to real and simulated data sets using computer software.

Prerequisites

The prerequisites are EDMS 651 (Generalized Linear Models II) and 623 (Applied Measurement: Issues and Practices). Students are expected to be **familiar with the statistical computing environment R**. Background knowledge in probability theory, mathematical statistics, and calculus is helpful, although not absolutely mandatory.

Objectives

Students who attend EDMS 724 have already been exposed to (generalized) linear models and classic test theory (CTT). The expectations of the course are

- to learn the statistical language of IRT
- to run an IRT software program
- to perform item analysis, test assembly, and scoring in real data problems
- to improve the skills in R programming and plotting
- to further practice academic writing in APA style

References

There is **no required textbook** for this course. We will be reading book chapters and journal articles each week that will be posted on the course website. In addition, the following books may be useful throughout the course (wait for the instructor's explanation before purchasing):

- van der Linden, W. J. (Ed.). (2017). Handbook of item response theory: Vols. 1--3. Boca Raton, FL: CRC Press.
- Reise, S. P., & Revicki, D. A. (Eds.). (2014). Handbook of item response theory modeling: Applications to typical performance assessment. New York, NY: Routledge.
- Nering, M. L., & Ostini, R. (Eds.). (2011). Handbook of polytomous item response theory models. Taylor & Francis.
- van der Linden, W. J., & Hambleton, R. K. (Eds.). (1997). Handbook of modern item response theory. New York, NY: Springer.
- Thissen, D., & Wainer, H. (2001). Test scoring. Mahwah, NJ: Lawrence Erlbaum Associates, Inc.
- Embretson, S. E. & Reise, S. P. (2000). Item response theory for psychologists. Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

Course Delivery

The class meets every Wednesday from 4:15 to 7:00pm at EDU (Benjamin Bldg) 3236. Course slides and supplemental materials will be made available by 10am every Wednesday on the [ELMS Canvas system](#). An automatic email notification will be sent out by ELMS when new materials are posted.

Course Assignment

Homework (45%) There will be **three homework assignments** throughout the semester, each of which is worth 15% of the final grade and contains problems related to the class materials. Students are expected to refer to materials from lecture slides and supplementary notes.

Students are encouraged to work in groups on homework but the **writing must reflect individual work**. Copying other students writing is considered plagiarism, even among students who form a study group to complete the assignment collaboratively. Formatting should conform as closely as possible to the **APA-style** presentation of tables, graphics, and references. Students are expected to report statistical results as if it were going into a journal article or a thesis, and include the original software output as an appendix to show how they arrive at the solution. Please **do not just cut and paste all the software output** into the writing without necessary interpretation and formatting.

Please note that **late homework will not be accepted** unless pre-approval is given for exceptional circumstances. The homework **must be typed**: Students are required to hand in a **printed copy** at the beginning of the class on the specified due date. It might be wise to keep a photocopy or at the very least save assignments electronically for your own protection. Graded assignments will typically be returned during the next lecture. Homework will be graded on a scale of **P (pass) or L (low pass)**. Getting a P means receiving a full credit for the particular assignment. In case of an L grade, partial credit will be assigned depending on the level of completion.

Reading and Class Participation (15%) Relevant book chapters and/or journal articles will be posted a week before the class meeting, which will serve as the topical focus. Every student is expected to **read the posted materials** prior to the lecture, and **write one (or optionally more) questions** that can facilitate the discussion during class. Those questions are to be **emailed to me (yliu87@umd.edu) by noon on each Tuesday preceding class**. We will spend **about 30 minutes** to discuss those questions each week. Unless you get my approval ahead of time, **1% will be taken off for each missing or late reading assignment**.

Final Project (40%) The final project consists of an in-class presentation (20%) and a paper submission (20%). There are two options for the project: (a) studying and extending the current **methodology**, or (b) applying the existing methodology to **empirical data analysis**. **Individual work is required** for the final project, although discussions among students about the study design, interpretation of results, etc., are highly encouraged. A **short description** of the project should be submitted by the due date (please see the tentative schedule for more information), and the **topic must be approved by the instructor**. Students are welcome to discuss the project with the instructor during office hours or by appointment.

The final paper must be **typed** and follow as closely as possible to the **APA format**. The length of the paper must be **no more than 15 pages (double-spaced, excluding figures, tables, and references)**. Detailed grading rubric regarding the in-class presentation and paper will be provided later.

Grading Scheme

Table 1: Grading scheme

Letter grade	Percentage	Letter grade	Percentage
A+	98.00--100.00%	C+	75.00--77.99%
A	92.00--97.99%	C	72.00--74.99%
A-	88.00--91.99%	C-	68.00--71.99%
B+	85.00--87.99%	D+	65.00--67.99%
B	82.00--84.99%	D	62.00--64.99%
B-	78.00--81.99%	D-	58.00--61.99%
		F	0.00--57.99%

With exceptions of computational error, **grades will not be changed once they are posted**. The **incomplete grade is not an option for poor performance** in the course. Unless the student can provide very compelling reasons with proof documents, incomplete will not be given.

Tentative Schedule

Table 2: Tentative schedule (subject to change)

Week	Date	Topic	Due
1	1/26	Introduction; history of IRT	
2	2/2	Models for dichotomous responses	
3	2/9	Test scoring I	
4	2/16	Test scoring II	Homework 1
5	2/23	Models for ordinal responses	
6	3/2	Models for nominal responses	
7	3/9	Parameter estimation I	Homework 2
8	3/16	Parameter estimation II; item factor analysis	Project description
9	3/23	Spring break, no class	
10	3/30	Multiple group IRT	
11	4/6	Differential item functioning; test linking	
12	4/13	Goodness of fit assessment	
13	4/20	Sources of model misfit	Homework 3
14	4/27	NCME conference, no class	
15	5/4	Final project presentation	
16	5/11		Final paper

Course Procedures and Policies

Please visit <https://gradschool.umd.edu/course-related-policies> for a summary of course-related policies. See below for several points to emphasize.

Masking Requirement [University policy](#) requires that **masks be worn over the nose and mouth while indoors at all times, regardless of vaccination status**. There are no exceptions. Students not wearing a mask will be given a warning and asked to wear one, or will be asked to leave the classroom immediately. Students who have additional issues with the mask expectation after a first warning will be referred to the Office of Student Conduct for failure to comply with a directive of University officials.

Accommodations for emergency and email communication All students are expected to submit assignments and exams on the specified dates. You must contact the instructor ahead of time if re-scheduling is needed or delays are expected; otherwise, not being able to submit the assignment in time will result in a zero score for that assessment. The primary communication tool will be email in cases of emergency. Emergency deserves prompt replies, but last minute questions with respect to assignments might not be well taken. I strongly recommend that you should plan ahead to meet the deadlines properly.

Accessibility and Disability Services The University of Maryland is committed to creating and maintaining a welcoming and inclusive educational, working, and living environment for people of all abilities. The University of Maryland is also committed to the principle that no qualified individual with a disability shall, on the basis of disability, be excluded from participation in or be denied the benefits of the services, programs, or activities of the University, or be subjected to discrimination. The [Accessibility & Disability Service \(ADS\)](#) provides reasonable accommodations to qualified individuals to provide equal access to services, programs and activities. ADS cannot assist retroactively, so it is generally best to request accommodations several weeks before the semester begins or as soon as a disability becomes known. Any student who needs accommodations should contact me as soon as possible so that I have sufficient time to make arrangements. For assistance in obtaining an accommodation, contact Accessibility and Disability Service at 301-314-7682, or email them at adsfrontdesk@umd.edu. Information about [sharing your accommodations with instructors](#), [note taking assistance](#) and more is available from the [Counseling Center](#).

Academic integrity The University of Maryland, College Park, has a nationally recognized Code of Academic Integrity, administered by the Student Honor Council. This Code sets standards for academic integrity at Maryland for all undergraduate and graduate students. As a student you are responsible to uphold these standards for this course. It is imperative that you are aware of the consequences of **cheating, fabrication, facilitation, and plagiarism**. For more information on the code of Academic Integrity or the Student Honor Council, please see <http://www.president.umd.edu/policies/docs/III-100A.pdf>. Plagiarism and other forms of academic fraud are a violation of university regulations and unacceptable under any circumstance. These instances have to be and will be reported to the Honor Council in writing. Notes on plagiarism in this class:

Due to the nature of reporting statistical results, some expressions are commonly used and should be phrased in the same/similar ways. However, how to approach a problem and end up with the solution is definitely a result of logic process, and this should not be stolen and used with proper citations.

Religious observances The University of Maryland policy on religious observances states that students not be penalized in any way for participation in religious observances. Students shall be allowed, whenever possible, to make up academic assignments that are missed due to such absences. However, they must contact the instructor **before the absence** with a written notification of the projected absence, and arrangements will be made for make-up work or examinations.

Student Resources and Services Taking personal responsibility for your own learning means acknowledging when your performance does not match your goals and doing something about it. I hope you will come talk to me so that I can help you find the right approach to success in this course, and I encourage you to visit [UMD's Student Academic Support Services](#) website to learn more about the wide range of campus resources available to you. In particular, everyone can use some help sharpening their communication skills (and improving their grade) by visiting [UMD's Writing Center](#) and schedule an appointment with the campus Writing Center. You should also know there are a wide range of resources to support you with whatever you might need ([UMD's Student Resources and Services website](#) may help). If you feel it would be helpful to have someone to talk to, visit [UMD's Counseling Center](#) or one of the many other [mental health resources on campus](#).

Basic Needs Security If you have difficulty affording groceries or accessing sufficient food to eat every day, or lack a safe and stable place to live, please visit [UMD's Division of Student Affairs website](#) for information about resources the campus offers you and let me know if I can help in any way.

Participation The classes will be composed of lectures and small group/class discussions. Each student's meaningful participation is very appreciated and will contribute to the entire learning process, promoting critical thinking skills. Throwing questions and bringing in topic-related problems to class are always welcomed.

Course Evaluation Please submit a course evaluation through CourseEvalUM in order to help faculty and administrators improve teaching and learning at Maryland. All information submitted to CourseEvalUM is confidential. Campus will notify you when CourseEvalUM is open for you to complete your evaluations for fall semester courses. Please go directly to the [Course Eval UM website](#) to complete your evaluations. By completing all of your evaluations each semester, you will have the privilege of accessing through Testudo, the evaluation reports for the thousands of courses for which 70% or more students submitted their evaluations.

Copyright Notice Course materials are copyrighted and may not be reproduced for anything other than personal use without written permission.