ERM 667 - *Foundations of Educational Measurement Theory*

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Course Overview: This course provides an introduction to the measurement concepts and models along the continuum of modern test theory. This continuum is essentially a function of the number of assumptions that underlie the various measurement models. At one end is the simplest model from Classical Test Theory (CTT); at the other extreme are the most complicated models contained in Item Response Theory (IRT). The course will focus primarily on the CTT and IRT models and their applications.

After a brief statistical review we will begin examining the assumptions and resulting conclusions of CTT. With these as a basis we will then concentrate on important issues central to all measurement such as reliability, validity, test construction, and equating. We then will move along the modern test theory continuum to the binomial error model, the Poisson model, and finally IRT models. Similarities and differences of the various models will be discussed. Several class periods will be spent looking at the IRT assumptions, the various IRT models and how their parameters are estimated. We will end the semester looking at two key applications of IRT, namely computerized adaptive testing and differential item functioning (e.g., item/test bias).

This course is designed for practitioners who will develop, evaluate, and select measurement instruments in their professional role.

Course Objectives: After successfully completing this class you should

1. Be more "measurement literate". That is, you should be able to read, interpret, and critically evaluate measurement methodology, reported outcomes and subsequent interpretations, as discussed in educational or behavioral research journals.

2. Be able to conduct a complete item/test analysis from both a CTT and an IRT perspective

3. Be able to conduct a complete item bias (DIF) analysis and interpret the results.

4. Be able to conduct an IRT calibration of both item and ability parameters and interpret the results.

5. Become proficient with item analysis and IRT software.

Textbooks: There are two required texts:

Allen, Mary J. & Yen, Wendy M. (1979). ***Introduction to Measurement Theory*** Monterey, CA: Brooks/Cole Publishing.

Hambleton,Ronald K., Swaminathan, H. & Rogers, Jane. (1991). ***Fundamentals of Item Response Theory***. Newbury Park, CA: Sage Publications, Inc.

Course Requirements:

Homework:

Homework assignments will consist mainly of problems from the textbooks but on occasion I may substitute questions from other texts. Whenever possible you should show all of your work. Make sure you put your name and indicate the exercise set number at the top of your paper and that you ***highlight*** your answers. For problems done on the computer simply attach a copy of the output and highlight your answers. Homework will usually be due at the beginning of class **after** it has been covered in lecture. Due dates will always be specified. Homework will be graded and returned to you the week after it is received.

Exams:

There will be one midterm exam and one final exam. The exams are NOT cumulative. Questions will be testing the learning objectives as stated in the handouts. Exams will be "take home" exams. They will be passed out at the end of class and due at the beginning of the next class. The UNCG *Academic Integrity Policy* applies for all examinations.

One week prior to each exam students will receive a description of what the exam will cover, and a practice exam. I will pass out the answers and go through the practice exam at review sessions. There will be review sessions (we'll decide on times so that everyone can attend at least one) held outside of our regular class time to go over the practice exam, homework, and any other questions students may have. Review sessions are not mandatory.

Exam Dates

	Exam Passed Out	*Exam Due*
MIDTERM	Week 8	Week 9
FINAL	Week 15	Week 16

3. **Project:** A paper on a selected measurement problem will be required. Papers can vary from reviews of the literature on a selected measurement topic, or may involve computer simulations or analyses of your own or existing data sets. Topics may be selected from a wide range of possibilities, but must be cleared with me in advance. This should be done by submitting a brief, one-page project proposal. The proposal can be handed in any time before **Week 12**. Final projects are due on the last day of class, Week 15.

Grading

Your grade will be determined by your performance on your exams and your exercise sets using the following criteria. There will be 10 exercise sets, each worth 10 points, for a possible total of

100 points. Both of the exams and the project be worth 100 points each. Thus, the total number of possible points is 400.

Point Range	Grade	Point Range	Grade
360-400	A	280-299	B-
340-359	A-	240-279	C
320-339	B+	0-239	F
300-319	B		

Lectures

At the beginning of each class I will pass out a handout of my lecture. The handout will contain a list of the learning objectives (things I want you to learn from the lecture), a list of key vocabulary and an outline of the lecture. I will try to supplement the two texts with as many examples as possible. Whenever computer work is involved I will always demonstrate the programs and explain the necessary input and output in class. Many of the programs we will use have been written by myself or my colleagues and are free for the taking. I would encourage you to start a directory on your home computer for this class.

Organization

It is extremely important to be organized. I suggest that you purchase a 2 1/2" three-ring binder for your handouts and notes. Organization will facilitate and promote understanding. To help you out all handouts will be holed-punched and will be color coded as follows:

Handout	*Color*
Notes, Pretest & Answers	White
Example Problems/solutions	Blue
Annotated examples of Computer Programs	Yellow
Homework assignments	Pink
Journal article examples	Green

Class attendance

The lectures and in-class discussions will supplement, not duplicate, the material in your text book. It is important to attend class regularly. If you need to miss a class, please let me know so arrangements can be made to get you a copy of the handouts.

Asking questions

Whenever something is covered in lecture and you do not clearly understand please do not be afraid to ask for further clarification. Sometimes students avoid asking simply because they're lost and feel they don't even know how to phrase a question. All you need to do is just ask me to repeat or clarify and I will be happy to reword or give more examples so that you can understand the material better. ***Reading assignments should be done BEFORE class – it will make the lectures more understandable.***

Tentative Schedule*

A&Y = Allen and Yen text
HSR = Hambleton, Swaminathan, and Rogers text

Week	**Topic**	**Reading Assignment**
1	Course overview; review of statistical concepts	A&Y: Chs.1 & 2 pp. 1-52
2	Finish statistical review; Classical Test Theory: Assumptions and basic results	A&Y: Ch. 3 pp. 56-71
3	Reliability	A&Y: Ch. 4 pp. 72-92
4	Finish Reliability/Generalizability Theory	A&Y: pp.230-231 Brennan Chs. 1&2 pp. 1-20
5 and 6	Validity	A&Y: Ch. 5 pp. 95-114
7	Principles of Test Construction	A&Y: Ch. 6 pp. 118-142
8	Finish test construction/ Pass out MIDTERM	
9	Transforming and Equating Test Scores; Scaling	A&Y: Ch. 7,8 pp. 148-191
10	Strong true score models	A&Y: Ch. 11 pp. 239-269
11 and 12	Item Response Theory (IRT) Concepts, Models & estimation	HS&R: Chs. 1-3, pp.1-52
13	The Ability Scale/Test Information Function	HS&R: Chs. 4,5 pp 53-98
14	Computerzied Adaptive Testing	HS&R: Chs. 10 pp. 145-152
15	Item bias/Differential Item functioning Passout FINAL EXAM	Handout
16	FINAL EXAM DUE	

The above schedule is only approximate and may change to allow for expanding or reducing the coverage of certain topics.