



Educational Research and Measurement 8630
Applications of Item Response Theory
Spring Semester 2012
Instructor: Seock-Ho Kim

Syllabus

Course Description and Objective

Applications of item response theory (IRT) to practical testing problems, including test equating, differential item functioning, computerized adaptive testing, and test construction. Dichotomous and polytomous item response theory models with strong emphasis on computer applications (*Graduate Bulletin*). Prerequisite: ERSH 8620

We will consider applications of item response theory in educational and psychological measurement. In addition to the usual models for the dichotomously scored items (e.g., one-parameter logistic or Rasch, two-parameter logistic, and Birnbaum's three-parameter models) many item response theory models for polytomous items (e.g., nominal categories, rating scale, graded response, partial credit, generalized partial credit models) will be reviewed. Applications of these models to practical measurement situations will be studied using computer programs (e.g., BILOG-MG, PC-LOGIST, TESTFACT, WINSTEPS, FACETS, OPLM, WINMIRA, MULTILOG, PARSCALE, WinBUGS). Test equating/linking, differential item functioning, instrument construction, and adaptive testing are some examples of application topics.

The primary objective of the course is to sharpen the skill, sophistication, and intuition of the student in the interpretation of educational and psychological test data, and in the construction and use of tests as instruments of educational and psychological theory and as tools in the practical problems of selection, evaluation, and guidance in the light of item response theory.

Specific objectives are:

1. To differentiate item response theory from classical test theory.
2. To become familiar with item response theory models for both dichotomous and polytomous item response data.
3. To know the fields of applications, for example, test construction, test equating/linking, differential item functioning, adaptive testing, etc.
4. To be able to select/use different item response theory models for specific applications.

5. To be able to use various item response theory computer programs to analyze test data for specific applications.
6. To evaluate current literature of item response theory and its application.
7. To write research proposals in the application areas of item response theory.

Textbook

van der Linden, W. J., & Hambleton, R. K. (Eds.). (1997). *Handbook of modern item response theory*. New York: Springer.

Selected chapters from Hambleton et al. (1991) and de Ayala (2009).

Suggested Supplementary Texts

Baker, F. B., & Kim, S.-H. (2004). *Item response theory: Parameter estimation techniques* (2nd ed.). New York: Marcel Dekker.

de Ayala, R. J. (2009). *The theory and practice of item response theory*. New York: The Guilford Press.

Embretson, S. E., & Reise, S. P. (2000). *Item response theory for psychologists*. Mahwah, NJ: Erlbaum.

Hambleton, R. K., Swaminathan, H., & Rogers, H. J. (1991). *Fundamentals of item response theory*. Newbury Park, CA: Sage.

Lord, F. M. (1980). *Applications of item response theory to practical testing problems*. Hillsdale, NJ: Erlbaum.

Yen, W. M., & Fitzpatrick, A. R. (2006). Item response theory. In R. L. Brennan (Ed.), *Educational measurement* (4th ed., pp. 111–153). Westport, CT: Praeger.

Assignments, Examinations, Project, and Evaluation

A number of exercises will be assigned and each student is expected to complete the exercises independently. All work must be completed and turned in on time. All work should be lucid, orderly, and self-contained.

There will be one midterm examination on February 28 (Tuesday, 11:00 am–12:15 pm) and a final examination on May 8 (Tuesday, Noon–3:00 pm). The midterm examination will be administered in class. The date and time of the final examination is based on the Final Examination Schedule. Both examinations will be composed of short answer and brief essay items. Specific objectives of the midterm and final examinations as well as copies of practice examinations will be distributed as additional handouts.

Two projects will be required. The first project is to write an abstract based on the call for papers of the Psychometric Society (i.e., less than 200 words). The other project is a research proposal for an application of item response theory that is in the format of either

National Council on Measurement in Education (NCME) or American Educational Research Association (AERA) proposal (i.e., maximum of 2,000 words or 3 pages). Specifications of the abstract and NCME/AERA proposal as well as copies of the sample abstract and proposal will be distributed later. The due date of the abstract is February 28 and the due date of the project is May 8. Note that both abstract and proposal will be presented in class before the respective due dates.

Grades will be based on completion of the exercises (10%), on the scores of the two examinations (30% each), and the abstract and project (30%). Full attendance of lectures is required. Grades will be assigned as follows: A (above 95%), A⁻ (between 90% and 95%), B⁺ (between 85% and 90%), B (between 80% and 85%), B⁻ (between 75% and 80%), C⁺ or worse (below 75%). Full attendance of lectures is required.

All academic work must meet the standards contained in “A Culture of Honesty.” Students are responsible for informing themselves about those standards before performing any academic work. The link to more detailed information about academic honesty can be found at: <http://www.uga.edu/honesty/>

Advice

On any aspect of the course, see Seock-Ho Kim, 325U Aderhold Hall from 10:00 to 11:00 am on Tuesday and Thursday or by appointment. For appointments or replies to brief questions, send email to shkim@uga.edu or call me at 706-542-4224 (office) or 706-310-1218 (home). If I am not available when you call 706-542-4224, you may call and leave a message at 706-542-4110 (i.e., the main office of the Department of Educational Psychology and Instructional Technology). If you leave a message, I will probably reply by email, rather than call you back.

Course Outline

January 10: Introduction

Hambleton (1991) Chapter 1

January 12: History

van der Linden (1997) Chapter 1

January 17: Dichotomous Models

Hambleton (1991) Chapter 2

January 19: Lab 1. GENIRV, TESTFACT

Hambleton (1991) Appendix B; Wood et al. (2002)

January 24: Parameter Estimation

Hambleton (1991) Chapter 3

January 26: Model-Data Fit

Hambleton (1991) Chapter 4

- January 31: The Ability Scale
Hambleton (1991) Chapter 5
- February 2: Lab 2. BILOG-MG, LOGIST
Zimowski et al. (2002); Wingersky et al. (1999)
- February 7: Information Function
Hambleton (1991) Chapter 6
- February 9: Test Construction
Hambleton (1991) Chapter 7
- February 14: Differential Item Functioning
Hambleton (1991) Chapter 8; de Ayala (2009) Chapter 12
- February 16: Lab 3. WINSTEPS, FACETS
Linacre (2003; 2002)
- February 21: Equating/Linking
Hambleton (1991) Chapter 9; de Ayala (2009) Chapter 11
- February 23: Adaptive Testing
Hambleton (1991) Chapter 10
- February 28: **Midterm Examination**
Hambleton (1991) Chapters 1–10; van der Linden (1997) Chapter 1; de Ayala (2009) Chapters 11, 12
- March 1: Lab 4. OPLM, WINMIRA
Verhelst, Glas, and Verstralen (1995); von Davier (2001)
- March 6: Nominal Categories Model
van der Linden (1997) Chapter 2
- March 8: Multiple Choice Model
van der Linden (1997) Chapter 3
- March 20: Rating Scale Model
van der Linden (1997) Chapter 4
- March 22: Lab 5. MULTILOG
Thissen, Chen, and Bock (2002)
- March 27: Graded Response Model
van der Linden (1997) Chapter 5
- March 29: Partial Credit Model
van der Linden (1997) Chapter 6

April 3: Generalized Partial Credit Model
van der Linden (1997) Chapter 9

April 5: Lab 6. PARSCALE
Muraki and Bock (2002)

April 10: Multiple-Attempt, Single-Item Response Models
van der Linden (1997) Chapter 12

April 19: Linear Logistic Rasch Model
van der Linden (1997) Chapter 13; de Ayala (2009) Appendix E

April 24: Multiple Group IRT
van der Linden (1997) Chapter 25

April 26: Lab 7. WINBUGS
Spiegelhalter et al. (2003)

May 8: **Final Examination**
van der Linden (1997) Chapters 2–6, 9, 12–13, 25; de Ayala (2009) Appendix E

Note

The course syllabus is a general plan for the course; deviations announced to the class by the instructor may be necessary.

January 2012

SUN	MON	TUE	WED	THU	FRI	SAT
1	2	3	4	5	6	7
8	9	10 Chap H1	11	12 Chap V1	13	14
15	16	17 Chap H2	18	19 Lab 1	20	21
22	23	24 Chap H3	25	26 Chap H4	27	28
29	30	31 Chap H5				

February 2012

SUN	MON	TUE	WED	THU	FRI	SAT
			1	2 Lab 2	3	4
5	6	7 Chap H6	8	9 Chap H7	10	11
12	13	14 Chap H8	15	16 Lab 3	17	18
19	20	21 Chap H9 Chap D12	22	23 Chap H10 Chap D11	24	25
26	27	28 Midterm Abstract	29			

March 2012

SUN	MON	TUE	WED	THU	FRI	SAT
				1 Lab 4	2	3
4	5	6 Chap V2	7	8 Chap V3	9	10
11	12	13	14	15	16	17
18	19	20 Chap V4	21	22 Lab 5	23	24
25	26	27 Chap V5	28	29 Chap V6	30	31

April 2012

SUN	MON	TUE	WED	THU	FRI	SAT
1	2	3 Chap V9	4	5 Lab 6	6	7
8	9	10 Chap V12	11	12	13	14
15	16	17	18	19 Chap V13	20	21
22	23	24 Chap V25	25	26 Lab 7	27	28
29	30					

May 2012

SUN	MON	TUE	WED	THU	FRI	SAT
		1	2	3	4	5
6	7	8 Final Proposal	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		