

**The Ohio State University
Colleges of the Arts and Sciences New Course Request**

Psychology

Academic Unit

Psychology

Book 3 Listing (e.g., Portuguese)

821 Fundamentals of Item Response Theory

Number

Title

Intro to IRT

G

3

18-Character Title Abbreviation

Level

Credit Hours

Summer

Autumn **X**

Winter

Spring

Year

2007

Proposed effective date, choose one quarter and put an "X" after it; and fill in the year. See the OAA curriculum manual for deadlines.

A. Course Offerings Bulletin Information

Follow the instructions in the OAA curriculum manual. If this is a course with decimal subdivisions, then use one New Course Request form for the generic information that will apply to all subdivisions; and use separate forms for each new decimal subdivision, including on each form the information that is unique to that subdivision. If the course offered is less than a quarter or a term, please complete the Flexibly Scheduled/Off Campus/Workshop Request form.

Description (*not to exceed 25 words*): **This course will introduce the basic concepts underlying item response theory and provide an overview of more advanced topics.**

Quarter offered:

Distribution of class time/contact hours: **1 2-1/2 hour class**

Quarter and contact/class time hours information should be omitted from Book 3 publication (yes or no):

Prerequisite(s): **Psychology 826,827,828 or Permission of Instructor**

Exclusion or limiting clause:

Repeatable to a maximum of _____ credit hours.

Cross-listed with:

Grade Option (Please check): Letter S/U Progress What is course is last in the series? _____

Honors Statement:

Yes No

GEC: Yes No

Admission Condition

Off-Campus:

Yes No

EM: Yes No

Course: Yes No

Other General Course Information:

(e.g. "Taught in English." "Credit does not count toward BSBA degree.")

B. General Information

Subject Code **421901**

Subsidy Level (V, G, T, B, M, D, or P) **D**

If you have questions, please email Jed Dickhaut at dickhaut.1@osu.edu.

1. Provide the rationale for proposing this course:

Item response theory has quickly become the dominant paradigm for addressing measurement issues in the social and behavioral sciences. There is currently no course on this campus devoted to item response theory. The proposed course fills this gap.

2. Please list Majors/Minors affected by the creation of this new course. Attach revisions of all affected programs.

This course is (check one): Required on major(s)/minor(s) A choice on major(s)/minors(s)
 An elective within major(s)/minor(s) A general elective:

3. Indicate the nature of the program adjustments, new funding, and/or withdrawals that make possible the implementation of this new course.
No adjustment necessary. This course is part of the regular teaching load of a new faculty member.

4. Is the approval of this request contingent upon the approval of other course requests or curricular requests?

Yes No List: _____

5. If this course is part of a sequence, list the number of the other course(s) in the sequence: _____

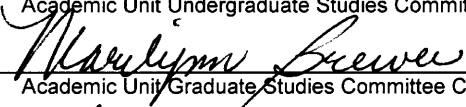

6. Expected section size: **12** Proposed number of sections per year: **1 every other year**

7. Do you want prerequisites enforced electronically (see OAA manual for what can be enforced)? Yes No

8. This course has been discussed with and has the concurrence of the following academic units needing this course or with academic units having directly related interests (*List units and attach letters and/or forms*):
 Not Applicable
Statistics

9. **Attach a course syllabus that includes a topical outline of the course, student learning outcomes and/or course objectives, off-campus field experience, methods of evaluation, and other items as stated in the OAA curriculum manual and e-mail to asccurrofc@osu.edu.**

Approval Process The signatures on the lines in ALL CAPS (e.g. ACADEMIC UNIT) are required.

1.	Academic Unit Undergraduate Studies Committee Chair	Printed Name	Date
		Marilynn Brewer	11/10/06
2.	Academic Unit Graduate Studies Committee Chair	Printed Name	Date
		Gifford Weary	11-16-06
3.	ACADEMIC UNIT CHAIR/DIRECTOR	Printed Name	Date
4.	After the Academic Unit Chair/Director signs the request, forward the form to the ASC Curriculum Office, 105 Brown Hall, 190 West 17 th Ave. or fax it to 688-5678. Attach the syllabus and any supporting documentation in an e-mail to asccurrofc@osu.edu . The ASC Curriculum Office will forward the request to the appropriate committee.		
5.	COLLEGE CURRICULUM COMMITTEE	Printed Name	Date
6.	ARTS AND SCIENCES EXECUTIVE DEAN	Printed Name	Date
7.	Graduate School (if appropriate)	Printed Name	Date
8.	University Honors Center (if appropriate)	Printed Name	Date
9.	Office of International Education (if appropriate)	Printed Name	Date
10.	ACADEMIC AFFAIRS	Printed Name	Date

Fundamentals of Item Response Theory

Psychology 821

Spring 2007

Lecture: Tuesdays, 10am-12:30pm
Psychology Building (PS) Room 217

Instructor: Michael C. Edwards
Lazenby 226
phone: 614-688-8030
email: edwards.134@osu.edu

Readings: All readings will be made available on the course website
in pdf format.

Website: This course will use Carmen.

Course Overview

Item response theory (IRT) has become increasingly popular in the past few decades in a wide variety of fields. Whether it is being used to create computerized adaptive tests for health related quality of life, allow for seamless equating in K-12 educational testing, or to create more precise measurement instruments in psychological testing, IRT has become an essential feature of the modern measurement landscape. This graduate level seminar will be broken into three sections. The first section will provide a brief overview of classical test theory (CTT), focusing on the assumptions typically made in CTT and how IRT allows us to relax those assumptions. The second portion of the class will cover the basic IRT models (2- & 3-parameter logistic, graded response model, etc.), with the emphasis on understanding the parameters and the basic concepts involved. This second part will also explore different software packages available for estimating the parameters of these models. Finally, we will briefly discuss several advanced topics to provide an overview of the wide variety of potential uses for IRT. Topics in this section will include: measurement invariance, computerized adaptive testing, linking, equating, and multidimensional IRT models.

Software

We will primarily use the IRT software package MULTILOG (Thissen, 1991). Free demonstration versions will be distributed for the purposes of the course. In addition to MULTILOG, we will briefly discuss factor analysis software capable of performing exploratory and confirmatory analyses with categorical measured variables. These software packages will include CEFA (Browne, Cudeck, Tateneni, & Mels, 2004) and LISREL (Jöreskog & Sörbom, 2003).

Grading Policies

There are no exams. There will be several (2 or 3) homework assignments involving data analysis and a (brief) report. These reports should contain tables with relevant output, graphics where helpful, and a verbal description of the results. There will be a final project, which will account for a major portion of your grade. The final project can be one of two flavors. Your first option is an IRT analysis of data you have which you would like to analyze. From time to time I will also be able to make data sets available to students who wish to pursue this option but do not have their own data. The second option is a review paper on some topic in IRT - either a topic we have covered in greater depth or a topic we do not cover. In either case, I expect that a satisfactory project will run somewhere between 10 and 20 pages. We will discuss the final project in greater detail as we progress through the quarter.

Class Participation

There will be weekly readings on each topic. Please complete the readings during the week before class and submit two questions for clarification or discussion by 5pm the Sunday before class. Please email your questions to me (edwards.134@osu.edu) using the subject line "QUESTIONS FOR IRT CLASS" (in all caps).

Students with Disabilities

Any student who feels s/he may need an accommodation based on the impact of a disability should contact me privately to discuss your specific needs. Please contact the Office for Disability Services at 614-292-3307 in room 150 Pomerene Hall to coordinate reasonable accommodations for students with documented disabilities.

Academic Misconduct

All students at the Ohio State University are bound by the Code of Student Conduct (see http://studentaffairs.osu.edu/resource_csc.asp). Suspected violations of the code in this class will be dealt with according to the procedures detailed in the code.

Tentative Schedule

Date	Topic	Readings
Sept 26	Classical Test Theory	Wainer & Thissen, 2001 Crocker & Algina, 1986, Ch.6
Oct 3	IRT Overview & Background	Hambleton, Swaminathan, & Rogers, 1991, Ch.1 Hambleton & Swaminathan, 1985, Ch.1 Hambleton & Swaminathan, 1985, Ch.2 Bock, 1997a
10	IRT for Dichotomous Responses	Thissen & Orlando, 2001, pp. 73-98 Steinberg & Thissen, n.d.-a, Ch.1
17	IRT for Polytomous Responses	Thissen, Nelson, Rosa, & McLeod, 2001, pp. 141-150 Steinberg & Thissen, n.d.-b, Ch.3 Bock, 1997b Samejima, 1997
24	Estimation & Scoring	Thissen & Orlando, 2001, pp. 98-140 Thissen et al., 2001, pp. 150-186 Wainer & Mislevy, 2000 Bock & Aitkin, 1981
31	MULTILOG	
Nov 7	Differential Item Functioning	Thissen, Steinberg, & Gerrard, 1986 Thissen, Steinberg, & Wainer, 1993 Steinberg, 2001
14	Linking & Equating	Kolen & Brennan, 2004, Ch. 6
21	Computerized Adaptive Testing	Wainer, 2000 Mills & Steffen, 2000 Thissen & Mislevy, 2000 Edwards & Thissen, 2003 Wainer & Eignor, 2000
28	Multidimensional IRT	Reckase, 1997 Ackerman, 2005 Edwards, 2005

References

- Ackerman, T. A. (2005). Multidimensional item response theory modeling. In A. Maydeu-Olivares & J. J. McArdle (Eds.), *Contemporary psychometrics* (p. 3-26). Mahwah, NJ: Lawrence Erlbaum Associates, Inc.
- Bock, R. D. (1997a). A brief history of item response theory. *Educational Measurement: Issues and Practice*, 16, 21-33.
- Bock, R. D. (1997b). The nominal categories model. In W. J. van der Linden & R. K. Hambleton (Eds.), *Handbook of modern item response theory* (p. 33-50). New York, NY: Springer.
- Bock, R. D., & Aitkin, M. (1981). Marginal maximum likelihood estimation of item parameters: An application of the EM algorithm. *Psychometrika*, 46, 443-459.
- Browne, M. W., Cudeck, R., Tateneni, K., & Mels, G. (2004). CEFA: Comprehensive Exploratory Factor Analysis, Version 2.00 [Computer software]. Retrieved from <http://quantrm2.psy.ohio-state.edu/browne/>.
- Crocker, L., & Algina, J. (1986). *Introduction to classical & modern test theory*. Belmont, CA: Wadsworth Group.
- Edwards, M. C. (2005). *A Markov chain Monte Carlo approach to confirmatory item factor analysis*. Unpublished doctoral dissertation, University of North Carolina at Chapel Hill.
- Edwards, M. C., & Thissen, D. (2003). *Finding mult-stage CAT designs associated with uniform item exposure and precise measurement*. (Unpublished manuscript)
- Hambleton, R. K., & Swaminathan, H. (1985). *Item response theory: Principles and applications*. Norwell, MA: Kluwer Academic Publishers.
- Hambleton, R. K., Swaminathan, H., & Rogers, H. J. (1991). *Fundamentals of item response theory*. Newbury Park, CA: Sage Publications.
- Jöreskog, K. G., & Sörbom, D. (2003). LISREL 8.54 [Computer software]. Chicago, IL: Scientific Software International, Inc.
- Kolen, M. J., & Brennan, R. L. (2004). *Test equating, scaling, and linking*. New York, NY: Springer.
- Mills, C. N., & Steffen, M. (2000). The GRE computer adaptive test: Operational issues. In W. J. van der Linden & C. A. W. Glas (Eds.), *Computerized adaptive testing: Theory and practice* (p. 75-99). Boston, MA: Kluwer Academic Publishers.
- Reckase, M. D. (1997). The past and future of multidimensional item response theory. *Applied*

Psychological Measurement, 21, 25-36.

- Samejima, F. (1997). Graded response model. In W. J. van der Linden & R. K. Hambleton (Eds.), *Handbook of modern item response theory* (p. 85-100). New York, NY: Springer.
- Steinberg, L. (2001). The consequences of pairing questions: Context effects in personality measurement. *Journal of Personality and Social Psychology*, 81, 332-342.
- Steinberg, L., & Thissen, D. (n.d.-a). *Chapter 1: An intellectual history of item response theory: Models for binary items*. From a draft of *Item response theory for psychological research*.
- Steinberg, L., & Thissen, D. (n.d.-b). *Chapter 3: A graded response model*. From a draft of *Item response theory for psychological research*.
- Thissen, D. (1991). MULTILOG: Multiple category item analysis and test scoring using item response theory [Computer software]. Chicago, IL: Scientific Software International, Inc.
- Thissen, D., & Mislevy, R. J. (2000). Testing algorithms. In H. Wainer et al. (Eds.), *Computerized adaptive testing: A primer* (2nd ed., p. 101-132). Mahwah, NJ: Lawrence Erlbaum Associates, Inc.
- Thissen, D., Nelson, L., Rosa, K., & McLeod, L. (2001). Item response theory for items scored in more than two categories. In D. Thissen & H. Wainer (Eds.), *Test scoring* (p. 141-186). Mahwah, NJ: Lawrence Erlbaum Associates, Inc.
- Thissen, D., & Orlando, M. (2001). Item response theory for items scored in two categories. In D. Thissen & H. Wainer (Eds.), *Test scoring* (p. 73-140). Mahwah, NJ: Lawrence Erlbaum Associates, Inc.
- Thissen, D., Steinberg, L., & Gerrard, M. (1986). Beyond group mean differences: The concept of item bias. *Psychological Bulletin*, 99, 118-128.
- Thissen, D., Steinberg, L., & Wainer, H. (1993). Detection of differential item functioning using the parameters of item response models. In P. W. Holland & H. Wainer (Eds.), *Differential item functioning* (p. 67-113). Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.
- Wainer, H. (2000). Introduction and history. In H. Wainer et al. (Eds.), *Computerized adaptive testing: A primer* (2nd ed., p. 1-20). Mahwah, NJ: Lawrence Erlbaum Associates, Inc.
- Wainer, H., & Eignor, D. (2000). Caveats, pitfalls, and unexpected consequences of implementing large-scale computerized testing. In H. Wainer et al. (Eds.), *Computerized adaptive testing: A primer* (2nd ed., p. 271-298). Mahwah, NJ: Lawrence Erlbaum Associates, Inc.
- Wainer, H., & Mislevy, R. J. (2000). Item response theory, item calibration, and proficiency estimation. In H. Wainer et al. (Eds.), *Computerized adaptive testing: A primer* (2nd ed., p.

61-100). Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

Wainer, H., & Thissen, D. (2001). True score theory: The traditional method. In D. Thissen & H. Wainer (Eds.), *Test scoring* (p. 73-140). Mahwah, NJ: Lawrence Erlbaum Associates, Inc.