

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

Psychology

Academic Unit

Psychology

821

Book 3 Listing (e.g., Portuguese)

Course Number

Summer      Autumn      Winter      Spring      Year      2008

**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 instructions in the OAA curriculum manual. Before you fill out the "Present Course" information, be sure to check the latest edition of the *Course Offerings Bulletin* and subsequent Circulating Forms. You may find that the changes you need have already been made or that additional changes are needed. If the course offered is less than quarter or term, please also complete the Flexibly Scheduled/OffCampus/Workshop Request form.

**COMPLETE ALL ITEMS THIS COLUMN**

**Present Course**

1. Book 3 Listing: Psychology

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2. Number: 821

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3. Full Title: Fundamentals of Item Response Theory

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4. 18-Char. Transcript Title: Intro to IRT

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5. Level and Credit Hours G 3

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6. Description: This course will introduce the basic (25 words or less) concepts underlying item response theory and provide an overview of more advanced topics

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7. Qtrs. Offered : Autumn

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8. Distribution of Contact Time: 1 2-1/2 hour class (e.g., 3 cl, 1 3-hr lab)

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9. Prerequisite(s): Psychology 826, 827, 828 or Permission Of Instructor

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10. Exclusion: (Not open to...)

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11. Repeatable to a maximum of \_\_\_\_\_ credits.

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12. Off-Campus Field Experience:

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13. Cross-listed with:

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14. Is this a GEC course? No

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15. Grade option (circle): Ltr S/U P  
If P graded, what is the last course in the series?

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16. Is an honors version of this course available? Y  N

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- Is an Embedded Honors version of this course available? Y  N

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17. Other general course information:

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**COMPLETE ONLY THOSE ITEMS THAT CHANGE**

**Changes Requested**

1. \_\_\_\_\_

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2. \_\_\_\_\_

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3. \_\_\_\_\_

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5. G 4

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11. \_\_\_\_\_

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12. \_\_\_\_\_

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14. \_\_\_\_\_

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15. \_\_\_\_\_

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16. \_\_\_\_\_

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17. \_\_\_\_\_

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**B. General Information**

1. Do you want the prerequisites enforced electronically (see the OAA manual for what can be enforced)?  
Yes.

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2. Does this course currently satisfy any GEC requirement, if so indicate which category?  
No.

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3. What other units require this course? Have these changes been discussed with those units?  
No.

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4. Have these changes been discussed with academic units that might have a jurisdictional interest in the subject matter?  
Attach relevant letters.  
Not Applicable.

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5. Is the request contingent upon other requests, if so, list the requests?  
No.

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6. **Purpose of the proposed change. (If the proposed change affects the content of the course, attach a revised syllabus and course objectives and e-mail to [asccurrofc@osu.edu](mailto:asccurrofc@osu.edu).)**  
Readings and projects are taking approximately 10 hours per week outside of class.

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7. Please list Majors/Minors affected by the proposed change. 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:  
 Not Applicable.

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8. Describe any changes in library, equipment or other teaching aids needed as a result of the proposed change or if the proposed change involves budgetary adjustments, describe the method of funding:  
Not Applicable.

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

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|--|--------------------|----------|
| 1. Academic Unit Undergraduate Studies Committee Chair   | Printed Name       | Date     |
|  | Marilynn B. Brewer | 11/16/07 |
| 2. Academic Unit Graduate Studies Committee Chair  | Printed Name       | Date     |
|  | Clifford Weary     | 11-19-07 |
| 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 <sup>th</sup> Ave. or fax it to 688-5678. Attach the syllabus and any supporting documentation in an e-mail to <a href="mailto:asccurrofc@osu.edu">asccurrofc@osu.edu</a> . 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 Affairs (study tours only)  | 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 two 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. Each assignment accounts for 20% of your final grade. There will be a final project, which will account for the remaining 60% of your final 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](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 multi-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.