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Item Response Theory, though it has become a widely recognized tool in language testing research, is still not used frequently in practical language assessment projects. This book intends to provide a theoretical overview as well as to give practical guidance concerning the application of IRT in item bank building in a language testing context by presenting a particular project in a higher education setting. First published in 1980. Routledge is an imprint of Taylor & Francis, an informa company. Item Response Theory clearly describes the most recently developed IRT models and furnishes detailed explanations of algorithms that can be used to estimate the item or ability parameters under

various IRT models. Extensively revised and expanded, this edition offers three new chapters discussing parameter estimation with multiple groups, parameter estimation for a test with mixed item types, and Markov chain Monte Carlo methods. It includes discussions on issues related to statistical theory, numerical methods, and the mechanics of computer programs for parameter estimation, which help to build a clear understanding of the computational demands and challenges of IRT estimation procedures. Published in 1980, *Applications of Item Response Theory To Practical Testing Problems* is a valuable contribution to the field of Education. This book develops an intuitive understanding of IRT principles through the use of graphical displays and analogies to familiar psychological principles. It surveys contemporary IRT models, estimation methods, and computer programs. Polytomous IRT models are given central coverage since many psychological tests use rating scales. Ideal for clinical, industrial, counseling, educational, and behavioral medicine professionals and students familiar with classical testing principles, exposure to material covered in first-year graduate statistics courses is helpful. All symbols and equations are thoroughly explained verbally and graphically. Item response theory (IRT) is widely used in education and psychology and is expanding its applications to other social science areas, medical research, and business as well. *Using R for Item Response Theory Model Applications* is a practical guide for students, instructors, practitioners, and applied researchers who want to learn how to properly use R IRT packages to perform IRT model calibrations with their own data. This book provides practical line-by-line descriptions of how to use R IRT packages for various IRT models. The scope and

coverage of the modeling in the book covers almost all models used in practice and in popular research, including: dichotomous response modeling polytomous response modeling mixed format data modeling concurrent multiple group modeling fixed item parameter calibration modelling with latent regression to include person-level covariate(s) simple structure, or between-item, multidimensional modeling cross-loading, or within-item, multidimensional modeling high-dimensional modeling bifactor modeling testlet modeling two-tier modeling For beginners, this book provides a straightforward guide to learn how to use R for IRT applications. For more intermediate learners of IRT or users of R, this book will serve as a great time-saving tool for learning how to create the proper syntax, fit the various models, evaluate the models, and interpret the output using popular R IRT packages. Several decades of psychometric research have led to the development of sophisticated models for multidimensional test data, and in recent years, multidimensional item response theory (MIRT) has become a burgeoning topic in psychological and educational measurement. Considered a cutting-edge statistical technique, the methodology underlying MIRT can be complex, and therefore doesn't receive much attention in introductory IRT courses. However author Wes Bonifay shows how MIRT can be understood and applied by anyone with a firm grounding in unidimensional IRT modeling. His volume includes practical examples and illustrations, along with numerous figures and diagrams. Multidimensional Item Response Theory includes snippets of R code interspersed throughout the text (with the complete R code included on an accompanying website) to guide readers in exploring MIRT models, estimating the model parameters, generating

plots, and implementing the various procedures and applications discussed throughout the book. By using familiar concepts from classical measurement methods and basic statistics, this book introduces the basics of item response theory (IRT) and explains the application of IRT methods to problems in test construction, identification of potentially biased test items, test equating and computerized-adaptive testing. The book also includes a thorough discussion of alternative procedures for estimating IRT parameters and concludes with an exploration of new directions in IRT research and development. Item response theory (IRT) is a latent variable modeling approach used to minimize bias and optimize the measurement power of educational and psychological tests and other psychometric applications. Designed for researchers, psychometric professionals, and advanced students, this book clearly presents both the "how-to" and the "why" of IRT. It describes simple and more complex IRT models and shows how they are applied with the help of widely available software packages. Chapters follow a consistent format and build sequentially, taking the reader from model development through the fit analysis and interpretation phases that one would perform in practice. The use of common empirical data sets across the chapters facilitates understanding of the various models and how they relate to one another. In the decade of the 1970s, item response theory became the dominant topic for study by measurement specialists. But, the genesis of item response theory (IRT) can be traced back to the mid-thirties and early forties. In fact, the term "Item Characteristic Curve," which is one of the main IRT concepts, can be attributed to Ledyard Tucker in 1946. Despite these early research

efforts, interest in item response theory lay dormant until the late 1960s and took a backseat to the emerging development of strong true score theory. While true score theory developed rapidly and drew the attention of leading psychometricians, the problems and weaknesses inherent in its formulation began to raise concerns. Such problems as the lack of invariance of item parameters across examinee groups, and the inadequacy of classical test procedures to detect item bias or to provide a sound basis for measurement in "tailored testing," gave rise to a resurgence of interest in item response theory. Impetus for the development of item response theory as we now know it was provided by Frederic M. Lord through his pioneering works (Lord, 1952; 1953a, 1953b). The progress in the fifties was painstakingly slow due to the mathematical complexity of the topic and the nonexistence of computer programs. Drawing on the work of internationally acclaimed experts in the field, *Handbook of Item Response Theory, Volume Two: Statistical Tools* presents classical and modern statistical tools used in item response theory (IRT). While IRT heavily depends on the use of statistical tools for handling its models and applications, systematic introductions and reviews that emphasize their relevance to IRT are hardly found in the statistical literature. This second volume in a three-volume set fills this void. Volume Two covers common probability distributions, the issue of models with both intentional and nuisance parameters, the use of information criteria, methods for dealing with missing data, and model identification issues. It also addresses recent developments in parameter estimation and model fit and comparison, such as Bayesian approaches, specifically Markov chain Monte Carlo (MCMC) methods. "Item

Response Theory (IRT) is, increasingly, the psychometric method used for contemporary psychological tests. The goal of this book is to explain IRT. The book is especially useful to psychologists and social scientists familiar with small-scale cognitive and personality measures, of those who want to use IRT to analyze scales used in their own research. It is also useful for graduate students and practitioners who want to understand the contemporary, psychometric foundations of the tests they administer. Familiar psychological concepts are used to help explain various IRT principles. The book develops an intuitive understanding of IRT principles through its use of graphical displays and analysis of psychological principles." --Jacket.

Over the past several decades, item response theory (IRT) and item response modeling (IRM) have become increasingly popular in the behavioral, educational, social, business, marketing, clinical, and health sciences. In this book, Raykov and Marcoulides begin with a nontraditional approach to IRT and IRM that is based on their connections to classical test theory, (nonlinear) factor analysis, generalized linear modeling, and logistic regression. Application-oriented discussions follow next. These cover the one-, two-, and three-parameter logistic models, polytomous item response models (with nominal or ordinal items), item and test information functions, instrument construction and development, hybrid models, differential item functioning, and an introduction to multidimensional IRT and IRM. The pertinent analytic and modeling capabilities of Stata are thoroughly discussed, highlighted, and illustrated on empirical examples from behavioral and social research. This comprehensive Handbook focuses on the most used polytomous item response theory (IRT)

models. These models help us understand the interaction between examinees and test questions where the questions have various response categories. The book reviews all of the major models and includes discussions about how and where the models originated, conceptually and in practical terms. Diverse perspectives on how these models can best be evaluated are also provided. Practical applications provide a realistic account of the issues practitioners face using these models. Disparate elements of the book are linked through editorial sidebars that connect common ideas across chapters, compare and reconcile differences in terminology, and explain variations in mathematical notation. These sidebars help to demonstrate the commonalities that exist across the field. By assembling this critical information, the editors hope to inspire others to use polytomous IRT models in their own research so they too can achieve the type of improved measurement that such models can provide. Part 1 examines the most commonly used polytomous IRT models, major issues that cut across these models, and a common notation for calculating functions for each model. An introduction to IRT software is also provided. Part 2 features distinct approaches to evaluating the effectiveness of polytomous IRT models in various measurement contexts. These chapters appraise evaluation procedures and fit tests and demonstrate how to implement these procedures using IRT software. The final section features groundbreaking applications. Here the goal is to provide solutions to technical problems to allow for the most effective use of these models in measuring educational, psychological, and social science abilities and traits. This section also addresses the major issues encountered when using polytomous IRT models in

computerized adaptive testing. Equating test scores across different testing contexts is the focus of the last chapter. The various contexts include personality research, motor performance, health and quality of life indicators, attitudes, and educational achievement. Featuring contributions from the leading authorities, this handbook will appeal to measurement researchers, practitioners, and students who want to apply polytomous IRT models to their own research. It will be of particular interest to education and psychology assessment specialists who develop and use tests and measures in their work, especially researchers in clinical, educational, personality, social, and health psychology. This book also serves as a supplementary text in graduate courses on educational measurement, psychometrics, or item response theory. Item response theory (IRT) has moved beyond the confines of educational measurement into assessment domains such as personality, psychopathology, and patient-reported outcomes. Classic and emerging IRT methods and applications that are revolutionizing psychological measurement, particularly for health assessments used to demonstrate treatment effectiveness, are reviewed in this new volume. World renowned contributors present the latest research and methodologies about these models along with their applications and related challenges. Examples using real data, some from NIH-PROMIS, show how to apply these models in actual research situations. Chapters review fundamental issues of IRT, modern estimation methods, testing assumptions, evaluating fit, item banking, scoring in multidimensional models, and advanced IRT methods. New multidimensional models are provided along with suggestions for deciding among the family of IRT models

available. Each chapter provides an introduction, describes state-of-the-art research methods, demonstrates an application, and provides a summary. The book addresses the most critical IRT conceptual and statistical issues confronting researchers and advanced students in psychology, education, and medicine today. Although the chapters highlight health outcomes data the issues addressed are relevant to any content domain. The book addresses: IRT models applied to non-educational data especially patient reported outcomes Differences between cognitive and non-cognitive constructs and the challenges these bring to modeling. The application of multidimensional IRT models designed to capture typical performance data. Cutting-edge methods for deriving a single latent dimension from multidimensional data A new model designed for the measurement of constructs that are defined on one end of a continuum such as substance abuse Scoring individuals under different multidimensional IRT models and item banking for patient-reported health outcomes How to evaluate measurement invariance, diagnose problems with response categories, and assess growth and change. Part 1 reviews fundamental topics such as assumption testing, parameter estimation, and the assessment of model and person fit. New, emerging, and classic IRT models including modeling multidimensional data and the use of new IRT models in typical performance measurement contexts are examined in Part 2. Part 3 reviews the major applications of IRT models such as scoring, item banking for patient-reported health outcomes, evaluating measurement invariance, linking scales to a common metric, and measuring growth and change. The book concludes with a look at future IRT applications in health outcomes

measurement. The book summarizes the latest advances and critiques foundational topics such as multidimensionality, assessment of fit, handling non-normality, as well as applied topics such as differential item functioning and multidimensional linking. Intended for researchers, advanced students, and practitioners in psychology, education, and medicine interested in applying IRT methods, this book also serves as a text in advanced graduate courses on IRT or measurement. Familiarity with factor analysis, latent variables, IRT, and basic measurement theory is assumed. Drawing on the work of internationally acclaimed experts in the field, *Handbook of Item Response Theory, Volume Two: Statistical Tools* presents classical and modern statistical tools used in item response theory (IRT). While IRT heavily depends on the use of statistical tools for handling its models and applications, systematic introductions and reviews that emphasize their relevance to IRT are hardly found in the statistical literature. This second volume in a three-volume set fills this void. Volume Two covers common probability distributions, the issue of models with both intentional and nuisance parameters, the use of information criteria, methods for dealing with missing data, and model identification issues. It also addresses recent developments in parameter estimation and model fit and comparison, such as Bayesian approaches, specifically Markov chain Monte Carlo (MCMC) methods. This graduate-level textbook is a tutorial for item response theory that covers both the basics of item response theory and the use of R for preparing graphical presentation in writings about the theory. Item response theory has become one of the most powerful tools used in test construction, yet one of the barriers to learning and applying it is the considerable

amount of sophisticated computational effort required to illustrate even the simplest concepts. This text provides the reader access to the basic concepts of item response theory freed of the tedious underlying calculations. It is intended for those who possess limited knowledge of educational measurement and psychometrics. Rather than presenting the full scope of item response theory, this textbook is concise and practical and presents basic concepts without becoming enmeshed in underlying mathematical and computational complexities. Clearly written text and succinct R code allow anyone familiar with statistical concepts to explore and apply item response theory in a practical way. In addition to students of educational measurement, this text will be valuable to measurement specialists working in testing programs at any level and who need an understanding of item response theory in order to evaluate its potential in their settings. This volume provides an introduction to the range of polytomous models available within item response theory. It begins by outlining the distinction between the two major types of polytomous IRT models, then goes on to describe them in detail. A complete discussion of fundamental and advanced topics in Item Response Theory written by pioneers in the field In Item Response Theory, accomplished psychometricians Darrell Bock and Robert Gibbons deliver a comprehensive and up-to-date exploration of the theoretical foundations and applications of Item Response Theory (IRT). Covering both unidimensional and multidimensional IRT, as well as related adaptive test administration of previously calibrated item banks, the book addresses the growing need for understanding of this topic as the use of IRT spreads to other fields. The first book on the topic that offers a

complete and unified treatment of its subject, Item Response Theory prepares researchers and students to understand and apply IRT and multidimensional IRT to fields like education, mental health and marketing. Accessible to first year-graduate students with a foundation in the behavioral or social sciences, basic statistics, and generalized linear models, the book walks readers through everything from the logic of IRT to cutting edge applications of the technique. Readers will also benefit from the inclusion of:

- A thorough introduction to the foundations of Item Response Theory, including its logic and origins, model-based measurement, psychological scaling, and classical test theory
- An exploration of selected mathematical and statistical results, including points, point sets, and set operations, probability, sampling, and joint, conditional, and marginal probability
- Discussions of unidimensional and multidimensional IRT models, including item parameter estimation with binary and polytomous data
- Analysis of dimensionality, differential item functioning, and multiple group IRT

Perfect for graduate students and researchers studying and working with psychometrics in psychology, quantitative psychology, educational measurement, marketing, and statistics, Item Response Theory will also benefit researchers interested in patient reported outcomes in health research. Drawing on the work of 75 internationally acclaimed experts in the field, Handbook of Item Response Theory, Three-Volume Set presents all major item response models, classical and modern statistical tools used in item response theory (IRT), and major areas of applications of IRT in educational and psychological testing, medical diagnosis of patient-reported outcomes, and marketing research. It also covers CRAN packages,

WinBUGS, Bilog MG, Multilog, Parscale, IRTPRO, Mplus, GLLAMM, Latent Gold, and numerous other software tools. A full update of editor Wim J. van der Linden and Ronald K. Hambleton ' s classic Handbook of Modern Item Response Theory, this handbook has been expanded from 28 chapters to 85 chapters in three volumes. The three volumes are thoroughly edited and cross-referenced, with uniform notation, format, and pedagogical principles across all chapters. Each chapter is self-contained and deals with the latest developments in IRT. Item response theory (IRT) has moved beyond the confines of educational measurement into assessment domains such as personality, psychopathology, and patient-reported outcomes. Classic and emerging IRT methods and applications that are revolutionizing psychological measurement, particularly for health assessments used to demonstrate treatment effectiveness, are reviewed in this new volume. World renowned contributors present the latest research and methodologies about these models along with their applications and related challenges. Examples using real data, some from NIH-PROMIS, show how to apply these models in actual research situations. Chapters review fundamental issues of IRT, modern estimation methods, testing assumptions, evaluating fit, item banking, scoring in multidimensional models, and advanced IRT methods. New multidimensional models are provided along with suggestions for deciding among the family of IRT models available. Each chapter provides an introduction, describes state-of-the art research methods, demonstrates an application, and provides a summary. The book addresses the most critical IRT conceptual and statistical issues confronting researchers and advanced students in psychology, education, and medicine today.

Although the chapters highlight health outcomes data the issues addressed are relevant to any content domain. The book addresses: IRT models applied to non-educational data especially patient reported outcomes Differences between cognitive and non-cognitive constructs and the challenges these bring to modeling. The application of multidimensional IRT models designed to capture typical performance data. Cutting-edge methods for deriving a single latent dimension from multidimensional data A new model designed for the measurement of constructs that are defined on one end of a continuum such as substance abuse Scoring individuals under different multidimensional IRT models and item banking for patient-reported health outcomes How to evaluate measurement invariance, diagnose problems with response categories, and assess growth and change. Part 1 reviews fundamental topics such as assumption testing, parameter estimation, and the assessment of model and person fit. New, emerging, and classic IRT models including modeling multidimensional data and the use of new IRT models in typical performance measurement contexts are examined in Part 2. Part 3 reviews the major applications of IRT models such as scoring, item banking for patient-reported health outcomes, evaluating measurement invariance, linking scales to a common metric, and measuring growth and change. The book concludes with a look at future IRT applications in health outcomes measurement. The book summarizes the latest advances and critiques foundational topics such a multidimensionality, assessment of fit, handling non-normality, as well as applied topics such as differential item functioning and multidimensional linking. Intended for researchers, advanced students, and practitioners in psychology,

education, and medicine interested in applying IRT methods, this book also serves as a text in advanced graduate courses on IRT or measurement. Familiarity with factor analysis, latent variables, IRT, and basic measurement theory is assumed.

Introduction to measurement -- The one-parameter model -- Joint maximum likelihood parameter estimation -- Marginal maximum likelihood parameter estimation -- The two-parameter model -- The three-parameter model -- Rasch models for ordered polytomous data -- Non-Rasch models for ordered polytomous data -- Models for nominal polytomous data -- Models for multidimensional data -- Linking and equating -- Differential item functioning -- Multilevel IRT models. First thorough treatment of multidimensional item response theory

Description of methods is supported by numerous practical examples Describes procedures for multidimensional computerized adaptive testing This is a title in our Understanding Statistics series, which is designed to provide researchers with authoritative guides to understanding, presenting and critiquing analyses and associated inferences. Each volume in the series demonstrates how the relevant topic should be reported -- including detail surrounding what can be said, and how it should be said, as well as drawing boundaries around what cannot appropriately be claimed or inferred. This volume addresses an important issue for the design of survey instruments, which is rarely taught in graduate programs beyond those specifically for statisticians. Item Response Theory is used to describe the application of mathematical models to data from questionnaires and tests as a basis for measuring abilities, attitudes, or other variables. It is used for statistical analysis and development of assessments,

often for high stakes tests such as the Graduate Record Examination. The author is known for her clear, accessible writing; like all books in this series, this volume includes examples of both good and bad write-ups for methods sections of journal articles. Drawing on the work of internationally acclaimed experts in the field, *Handbook of Item Response Theory, Volume One: Models* presents all major item response models. This first volume in a three-volume set covers many model developments that have occurred in item response theory (IRT) during the last 20 years. It describes models for different response formats or response processes, the need of deeper parameterization due to a multilevel or hierarchical structure of the response data, and other extensions and insights. In Volume One, all chapters have a common format with each chapter focusing on one family of models or modeling approach. An introductory section in every chapter includes some history of the model and a motivation of its relevance. Subsequent sections present the model more formally, treat the estimation of its parameters, show how to evaluate its fit to empirical data, illustrate the use of the model through an empirical example, and discuss further applications and remaining research issues. Drawing on the work of internationally acclaimed experts in the field, *Handbook of Item Response Theory, Volume One: Models* presents all major item response models. This first volume in a three-volume set covers many model developments that have occurred in item response theory (IRT) during the last 20 years. It describes models for different response formats or response processes, the need of deeper parameterization due to a multilevel or hierarchical structure of the response data, and other extensions and insights. In Volume One, all

chapters have a common format with each chapter focusing on one family of models or modeling approach. An introductory section in every chapter includes some history of the model and a motivation of its relevance. Subsequent sections present the model more formally, treat the estimation of its parameters, show how to evaluate its fit to empirical data, illustrate the use of the model through an empirical example, and discuss further applications and remaining research issues. The measurement theories considered in this book fall into a sub-area of psychometrics. These theories are concerned with the specifications of rules for transforming individuals' responses to items on a psychological test or scale into estimates of the trait assumed to underlie the observable responses. Discussed is a particular class of measurement theories generally called item response theory or latent trait theory. This book is designed for those individuals involved in programs of applied testing and measurement whose efforts occasionally bring them into contact with the law and public policy. This is a highly accessible, comprehensive introduction to item response theory (IRT) models and their use in various aspects of assessment/testing. The book employs a mixture of graphics and simulated data sets to ease the reader into the material and covers the basics required to obtain a solid grounding in IRT. Written in an easily accessible way that assumes little mathematical knowledge, Carlson presents detailed descriptions of several commonly used IRT models, including those for items scored on a two-point (dichotomous) scale such as correct/incorrect, and those scored on multiple-point (polytomous) scales, such as degrees of correctness. One chapter describes a model in-depth and is followed by a

chapter of instructions and illustrations showing how to apply the models to the reader's own work. This book is an essential text for instructors and higher level undergraduate and postgraduate students of statistics, psychometrics, and measurement theory across the behavioral and social sciences, as well as testing professionals. Drawing on the work of internationally acclaimed experts in the field, *Handbook of Item Response Theory, Volume Two: Statistical Tools* presents classical and modern statistical tools used in item response theory (IRT). While IRT heavily depends on the use of statistical tools for handling its models and applications, systematic introductions and reviews that emphasize their relevance to IRT are hardly found in the statistical literature. This second volume in a three-volume set fills this void. Volume Two covers common probability distributions, the issue of models with both intentional and nuisance parameters, the use of information criteria, methods for dealing with missing data, and model identification issues. It also addresses recent developments in parameter estimation and model fit and comparison, such as Bayesian approaches, specifically Markov chain Monte Carlo (MCMC) methods. Every year roughly 100,000 fatal and injury crashes occur in the United States involving large trucks and buses. The Federal Motor Carrier Safety Administration (FMCSA) in the U.S. Department of Transportation works to reduce crashes, injuries, and fatalities involving large trucks and buses. FMCSA uses information that is collected on the frequency of approximately 900 different violations of safety regulations discovered during (mainly) roadside inspections to assess motor carriers' compliance with Federal Motor Carrier Safety Regulations, as well as to evaluate their

compliance in comparison with their peers. Through use of this information, FMCSA's Safety Measurement System (SMS) identifies carriers to receive its available interventions in order to reduce the risk of crashes across all carriers. Improving Motor Carrier Safety Measurement examines the effectiveness of the use of the percentile ranks produced by SMS for identifying high-risk carriers, and if not, what alternatives might be preferred. In addition, this report evaluates the accuracy and sufficiency of the data used by SMS, to assess whether other approaches to identifying unsafe carriers would identify high-risk carriers more effectively, and to reflect on how members of the public use the SMS and what effect making the SMS information public has had on reducing crashes. Drawing on the work of internationally acclaimed experts in the field, Handbook of Item Response Theory, Volume 3: Applications presents applications of item response theory to practical testing problems. While item response theory may be known primarily for its advances in theoretical modeling of responses to test items, equal progress has been made in its providing innovative solutions to daily testing problems. This third volume in a three-volume set highlights the major applications. Specifically, this volume covers applications to test item calibration, item analysis, model fit checking, test-score interpretation, optimal test design, adaptive testing, standard setting, and forensic analyses of response data. It describes advances in testing in areas such as large-scale educational assessment, psychological testing, health measurement, and measurement of change. In addition, it extensively reviews computer programs available to run any of the models and applications in Volume One and Three. Features Includes contributions from internationally

acclaimed experts with a history of advancing applications of item response theory Provides extensive cross-referencing and common notation across all chapters in this three-volume set Underscores the importance of treating each application in a statistically rigorous way Reviews major computer programs for item response theory analyses and applications. Wim J. van der Linden is a distinguished scientist and director of research and innovation at Pacific Metrics Corporation. Dr. van der Linden is also a professor emeritus of measurement and data analysis at the University of Twente. His research interests include test theory, adaptive testing, optimal test assembly, parameter linking, test equating, and response-time modeling as well as decision theory and its applications to problems of educational decision making. By using familiar concepts from classical measurement methods and basic statistics, this book introduces the basics of item response theory (IRT) and explains the application of IRT methods to problems in test construction, identification of potentially biased test items, test equating and computerized-adaptive testing. The book also includes a thorough discussion of alternative procedures for estimating IRT parameters and concludes with an exploration of new directions in IRT research and development. Item response theory (IRT) has become the mainstream measurement approach in social sciences concomitant with rising concerns about classical measurement techniques approach estimated item and person parameters. Related to this concern is how comparisons between different test forms could lead to somewhat inconsistent results. With IRT, comparable person estimates can be achieved irrespective of the specific set of items taken. Consequently, results

from studies using different test forms can be combined. Also, comparable item estimates can be obtained irrespective of the specific group of subjects taking them. Further, IRT methods place persons and items on the same measurement scale and make comparisons between persons and items feasible. Applications of IRT models are increasingly used in developing a variety of test items in fields such as economics, education, psychology, and medicine. This entry focuses on three binary models: one-parameter logistic/Rasch, two-parameter logistic, and three-parameter logistic models followed by a brief introduction of some widely used polytomous models. Applications of IRT methods in computerized adaptive testing, linking, differential item functioning, item generation, and item banking are then discussed. Finally, a description of some popular software assisting in IRT modeling is provided with examples on how analyses are conducted. Item response theory has become an essential component in the toolkit of every researcher in the behavioral sciences. It provides a powerful means to study individual responses to a variety of stimuli, and the methodology has been extended and developed to cover many different models of interaction. This volume presents a wide-ranging handbook to item response theory - and its applications to educational and psychological testing. It will serve as both an introduction to the subject and also as a comprehensive reference volume for practitioners and researchers. It is organized into six major sections: the nominal categories model, models for response time or multiple attempts on items, models for multiple abilities or cognitive components, nonparametric models, models for nonmonotone items, and models with special assumptions. Each chapter in the book has been

written by an expert of that particular topic, and the chapters have been carefully edited to ensure that a uniform style of notation and presentation is used throughout. As a result, all researchers whose work uses item response theory will find this an indispensable companion to their work and it will be the subject's reference volume for many years to come. A must-have resource for researchers, practitioners, and advanced students interested or involved in psychometric testing

Over the past hundred years, psychometric testing has proved to be a valuable tool for measuring personality, mental ability, attitudes, and much more. The word 'psychometrics' can be translated as 'mental measurement'; however, the implication that psychometrics as a field is confined to psychology is highly misleading. Scientists and practitioners from virtually every conceivable discipline now use and analyze data collected from questionnaires, scales, and tests developed from psychometric principles, and the field is vibrant with new and useful methods and approaches. This handbook brings together contributions from leading psychometricians in a diverse array of fields around the globe. Each provides accessible and practical information about their specialist area in a three-step format covering historical and standard approaches, innovative issues and techniques, and practical guidance on how to apply the methods discussed.

Throughout, real-world examples help to illustrate and clarify key aspects of the topics covered. The aim is to fill a gap for information about psychometric testing that is neither too basic nor too technical and specialized, and will enable researchers, practitioners, and graduate students to expand their knowledge and skills in the area. Provides comprehensive coverage of the field of psychometric

testing, from designing a test through writing items to constructing and evaluating scales Takes a practical approach, addressing real issues faced by practitioners and researchers Provides basic and accessible mathematical and statistical foundations of all psychometric techniques discussed Provides example software code to help readers implement the analyses discussed Noted for addressing both the "hows" and "whys" of item response theory (IRT), this text has been revised and updated with the latest techniques (multilevel models, mixed models, and more) and software packages. Simple to more complex models are covered in consistently formatted chapters that build sequentially. The book takes the reader from model development through the fit analysis and interpretation phases that would be performed in practice. To facilitate understanding, common data sets are used across chapters, with the examples worked through for increasingly complex models. Exemplary model applications include free (BIGSTEPS, NOHARM, Facets, R packages) and commercial (BILOG-MG, flexMIRT, SAS, WINMIRA, SPSS, SYSTAT) software packages. The companion website provides data files and online-only appendices. New to This Edition *Chapter on multilevel models. *New material on loglinear models, mixed models, the linear logistic trait model, and fit statistics. *Many additional worked-through examples. *Updated guidance on software; now includes R, SAS, and flexMIRT. The modeling of item response data is governed by item response theory, also referred to as modern test theory. The field of inquiry of item response theory has become very large and shows the enormous progress that has been made. The mainstream literature is focused on frequentist statistical methods for - timating

model parameters and evaluating model fit. However, the Bayesian methodology has shown great potential, particularly for making further improvements in the statistical modeling process. The Bayesian approach has two important features that make it attractive for modeling item response data. First, it enables the possibility of incorporating nondata information beyond the observed responses into the analysis. The Bayesian methodology is also very clear about how additional information can be used. Second, the Bayesian approach comes with powerful simulation-based estimation methods. These methods make it possible to handle all kinds of priors and data-generating models. One of my motives for writing this book is to give an introduction to the Bayesian methodology for modeling and analyzing item response data. A Bayesian counterpart is presented to the many popular item response theory books (e.g., Baker and Kim 2004; De Boeck and Wilson, 2004; Hambleton and Swaminathan, 1985; van der Linden and Hambleton, 1997) that are mainly or completely focused on frequentist methods. The usefulness of the Bayesian methodology is illustrated by discussing and applying a range of Bayesian item response models. This volume introduces social science students and researchers to the theory and practice of the highly powerful methods of nonparametric item response theory (IRT).