

Generalised Bi Ideals In Ordered Ternary Semigroups

In this paper we have defined neutrosophic ideals, neutrosophic interior ideals, neutrosophic quasi-ideals and neutrosophic bi-ideals (neutrosophic generalized bi-ideals) and proved some results related to them.

This graduate-level text provides a thorough grounding in the representation theory of finite groups over fields and rings. The book provides a balanced and comprehensive account of the subject, detailing the methods needed to analyze representations that arise in many areas of mathematics. Key topics include the construction and use of character tables, the role of induction and restriction, projective and simple modules for group algebras, indecomposable representations, Brauer characters, and block theory. This classroom-tested text provides motivation through a large number of worked examples, with exercises at the end of each chapter that test the reader's knowledge, provide further examples and practice, and include results not proven in the text. Prerequisites include a graduate course in abstract algebra, and familiarity with the properties of groups, rings, field extensions, and linear algebra.

The Second International Conference on Fuzzy Information and Engineering (ICFIE2007) is a major symposium for scientists, engineers and practitioners in China as well as the world to present their latest results, ideas, developments and applications in all areas of fuzzy information and knowledge engineering. It aims to strengthen relations between industry research laboratories and universities, and to create a primary symposium for world scientists.

The topics discussed in this book are Int-soft semigroup, Int-soft left (right) ideal, Int-soft (generalized) bi-ideal, Int-soft quasi-ideal, Int-soft interior ideal, Int-soft left (right) duo semigroup, starshaped $(\mathcal{F}, \mathcal{F} \text{ qk})$ -fuzzy set, quasi-starshaped $(\mathcal{F}, \mathcal{F} \text{ qk})$ -fuzzy set, semidetached mapping, semidetached semigroup, $(\mathcal{F}, \mathcal{F} \text{ qk})$ -fuzzy subsemi-group, $(\text{qk}, \mathcal{F} \text{ qk})$ -fuzzy subsemigroup, $(\mathcal{F}, \mathcal{F} \text{ qk})$ -fuzzy subsemigroup, $(\text{qk}, \mathcal{F} \text{ qk})$ -fuzzy subsemigroup, $(\mathcal{F} \text{ qk}, \mathcal{F} \text{ qk})$ -fuzzy subsemigroup, $(\mathcal{F}, \mathcal{F} \text{ qk})$ -fuzzy subsemigroup, $\mathcal{F} \text{ qk?}$ -level subsemigroup/bi-ideal, $(\mathcal{F}, \mathcal{F} \text{ qk?})$ -fuzzy (generalized) bi-ideal, \mathcal{F} -lower (\mathcal{F} -upper) approximation of fuzzy set, \mathcal{F} -lower (\mathcal{F} -upper) rough fuzzy subsemigroup, \mathcal{F} -rough fuzzy subsemigroup, Neutrosophic N -structure, neutrosophic N -subsemigroup, \mathcal{F} -neutrosophic N -subsemigroup, and neutrosophic N -product. The present book contains 20 articles collected from amongst the 53 total submitted manuscripts for the Special Issue "Fuzzy Sets, Fuzzy Logic and Their Applications" of the MDPI journal Mathematics. The articles, which appear in the book in the series in which they were accepted, published in Volumes 7 (2019) and 8 (2020) of the journal, cover a wide range of topics connected to the theory and applications of fuzzy systems and their extensions and generalizations. This range includes, among others, management of the uncertainty in a fuzzy environment; fuzzy assessment methods of human-machine performance; fuzzy graphs; fuzzy topological and convergence spaces; bipolar fuzzy relations; type-2 fuzzy; and intuitionistic, interval-valued, complex, picture, and Pythagorean fuzzy sets, soft sets and algebras, etc. The applications presented are oriented to finance, fuzzy analytic hierarchy, green supply chain industries, smart health practice, and hotel selection. This wide range of topics makes the book interesting for all those working in the wider area of Fuzzy sets and systems and of fuzzy logic and for those who have the proper mathematical background who wish to become familiar with recent advances in fuzzy mathematics, which has entered to almost all sectors of human life and activity.

This book introduces applications of mathematics and fuzzy mathematics in decision science, fuzzy geometric programming and fuzzy optimization as well as operations research and management, based on 44 research papers presented at three successful conferences: (1) The International Conference on Mathematics and Decision Science (ICMDS), September 12–15, 2016, Guangzhou University, Guangzhou, China (www.icodm2020.com). (2) Academic Conference on 30th Anniversary of Fuzzy Geometric Programming Advanced by Professor Cao Bingyuan and his 40 education years (ACFGPACE), July 30 to August 1, 2016, Guangzhou University, Guangzhou, China. (3) The third annual meeting of Guangdong Operational Research Society (TAMGORS), October 22–23, 2016, Foshan University, Guangdong, China. The book is a valuable resource for students, graduates, teachers and other professionals in the field of applied mathematics, artificial intelligence and computers, fuzzy systems and decision-making, as well as operations research and management.

This book provides a comprehensive introduction to the latest advances in the mathematical theory and computational tools for modeling high-dimensional data drawn from one or multiple low-dimensional subspaces (or manifolds) and potentially corrupted by noise, gross errors, or outliers. This challenging task requires the development of new algebraic, geometric, statistical, and computational methods for efficient and robust estimation and segmentation of one or multiple subspaces. The book also presents interesting real-world applications of these new methods in image processing, image and video segmentation, face recognition and clustering, and hybrid system identification etc. This book is intended to serve as a textbook for graduate students and beginning researchers in data science, machine learning, computer vision, image and signal processing, and systems theory. It contains ample illustrations, examples, and exercises and is made largely self-contained with three Appendices which survey basic concepts and principles from statistics, optimization, and algebraic-geometry used in this book. René Vidal is a Professor of Biomedical Engineering and Director of the Vision Dynamics and Learning Lab at The Johns Hopkins University. Yi Ma is Executive Dean and Professor at the School of Information Science and Technology at ShanghaiTech University. S. Shankar Sastry is Dean of the College of Engineering, Professor of Electrical Engineering and Computer Science and Professor of Bioengineering at the University of California, Berkeley.

This very well written and accessible book emphasizes the reasons for studying measure theory, which is the foundation of much of probability. By focusing on measure, many illustrative examples and applications, including a thorough discussion of standard probability distributions and densities, are opened. The book also includes many problems and their fully worked solutions.

It is increasingly common for analysts to seek out the opinions of individuals and organizations using attitudinal scales such as degree of satisfaction or importance attached to an issue. Examples include levels of obesity, seriousness of a health condition, attitudes towards service levels, opinions on products, voting intentions, and the degree of clarity of contracts. Ordered choice models provide a relevant methodology for capturing the sources of influence that explain the choice made amongst a set of ordered alternatives. The methods have evolved to a level of sophistication that can allow for heterogeneity in the threshold parameters, in the explanatory variables (through random parameters), and in the decomposition of the residual variance. This book brings together contributions in ordered choice modeling from a number of disciplines, synthesizing developments over the last fifty years, and suggests useful extensions to account for the wide range of sources of influence on choice.

Papers on neutrosophic programming, neutrosophic hypersoft set, neutrosophic topological spaces, NeutroAlgebra, NeutroGeometry, AntiGeometry, NeutroNearRings, neutrosophic differential equations, etc.

Praise for the Third Edition "Researchers of any kind of extremal combinatorics or theoretical computer science will welcome the new edition of this book." - MAA Reviews Maintaining a standard of excellence that establishes The Probabilistic Method as the leading reference on probabilistic methods in combinatorics, the Fourth Edition continues to feature a clear writing style, illustrative examples, and illuminating exercises. The new edition includes numerous updates to reflect the most recent developments and advances in discrete mathematics and the connections to other areas in mathematics, theoretical computer science, and statistical physics. Emphasizing the methodology and techniques that enable problem-solving, The Probabilistic Method, Fourth Edition begins with a description of tools applied to probabilistic arguments, including basic techniques that use expectation and variance

as well as the more advanced applications of martingales and correlation inequalities. The authors explore where probabilistic techniques have been applied successfully and also examine topical coverage such as discrepancy and random graphs, circuit complexity, computational geometry, and derandomization of randomized algorithms. Written by two well-known authorities in the field, the Fourth Edition features: Additional exercises throughout with hints and solutions to select problems in an appendix to help readers obtain a deeper understanding of the best methods and techniques New coverage on topics such as the Local Lemma, Six Standard Deviations result in Discrepancy Theory, Property B, and graph limits Updated sections to reflect major developments on the newest topics, discussions of the hypergraph container method, and many new references and improved results The Probabilistic Method, Fourth Edition is an ideal textbook for upper-undergraduate and graduate-level students majoring in mathematics, computer science, operations research, and statistics. The Fourth Edition is also an excellent reference for researchers and combinatorists who use probabilistic methods, discrete mathematics, and number theory. Noga Alon, PhD, is Baumritter Professor of Mathematics and Computer Science at Tel Aviv University. He is a member of the Israel National Academy of Sciences and Academia Europaea. A coeditor of the journal *Random Structures and Algorithms*, Dr. Alon is the recipient of the Polya Prize, The Gödel Prize, The Israel Prize, and the EMET Prize. Joel H. Spencer, PhD, is Professor of Mathematics and Computer Science at the Courant Institute of New York University. He is the cofounder and coeditor of the journal *Random Structures and Algorithms* and is a Sloane Foundation Fellow. Dr. Spencer has written more than 200 published articles and is the coauthor of *Ramsey Theory, Second Edition*, also published by Wiley.

This book provides a complete background on metaheuristics to solve complex bi-level optimization problems (continuous/discrete, mono-objective/multi-objective) in a diverse range of application domains. Readers learn to solve large scale bi-level optimization problems by efficiently combining metaheuristics with complementary metaheuristics and mathematical programming approaches. Numerous real-world examples of problems demonstrate how metaheuristics are applied in such fields as networks, logistics and transportation, engineering design, finance and security.

Issues in Artificial Intelligence, Robotics and Machine Learning: 2013 Edition is a ScholarlyEditions™ book that delivers timely, authoritative, and comprehensive information about Expert Systems. The editors have built *Issues in Artificial Intelligence, Robotics and Machine Learning: 2013 Edition* on the vast information databases of ScholarlyNews.™ You can expect the information about Expert Systems in this book to be deeper than what you can access anywhere else, as well as consistently reliable, authoritative, informed, and relevant. The content of *Issues in Artificial Intelligence, Robotics and Machine Learning: 2013 Edition* has been produced by the world's leading scientists, engineers, analysts, research institutions, and companies. All of the content is from peer-reviewed sources, and all of it is written, assembled, and edited by the editors at ScholarlyEditions™ and available exclusively from us. You now have a source you can cite with authority, confidence, and credibility. More information is available at <http://www.ScholarlyEditions.com/>.

Semihypergroup Theory is the first book devoted to the semihypergroup theory and it includes basic results concerning semigroup theory and algebraic hyperstructures, which represent the most general algebraic context in which reality can be modelled. Hyperstructures represent a natural extension of classical algebraic structures and they were introduced in 1934 by the French mathematician Marty. Since then, hundreds of papers have been published on this subject. Offers the first book devoted to the semihypergroup theory Presents an introduction to recent progress in the theory of semihypergroups Covers most of the mathematical ideas and techniques required in the study of semihypergroups Employs the notion of fundamental relations to connect semihypergroups to semigroups

This advanced graduate textbook gives an authoritative and insightful description of the major ideas and techniques of public key cryptography.

A new edition of a classic book originally published in 1970 and now updated and expanded to include the very latest developments. The volume remains the single most important book on the topic. Features an attractive cover.

This book is about Granular Computing (GC) - an emerging conceptual and of information processing. As the name suggests, GC concerns computing paradigm processing of complex information entities - information granules. In essence, information granules arise in the process of abstraction of data and derivation of knowledge from information. Information granules are everywhere. We commonly use granules of time (seconds, months, years). We granulate images; millions of pixels manipulated individually by computers appear to us as granules representing physical objects. In natural language, we operate on the basis of word-granules that become crucial entities used to realize interaction and communication between humans. Intuitively, we sense that information granules are at the heart of all our perceptual activities. In the past, several formal frameworks and tools, geared for processing specific information granules, have been proposed. Interval analysis, rough sets, fuzzy sets have all played important role in knowledge representation and processing. Subsequently, information granulation and information granules arose in numerous application domains. Well-known ideas of rule-based systems dwell inherently on information granules. Qualitative modeling, being one of the leading threads of AI, operates on a level of information granules. Multi-tier architectures and hierarchical systems (such as those encountered in control engineering), planning and scheduling systems all exploit information granularity. We also utilize information granules when it comes to functionality granulation, reusability of information and efficient ways of developing underlying information infrastructures.

This book provides a timely overview of fuzzy graph theory, laying the foundation for future applications in a broad range of areas. It introduces readers to fundamental theories, such as Craine's work on fuzzy interval graphs, fuzzy analogs of Marczewski's theorem, and the Gilmore and Hoffman characterization. It also introduces them to the Fulkerson and Gross characterization and Menger's theorem, the applications of which will be discussed in a forthcoming book by the same authors. This book also discusses in detail important concepts such as connectivity, distance and saturation in fuzzy graphs. Thanks to the good balance between the basics of fuzzy graph theory and new findings obtained by the authors, the book offers an excellent reference guide for advanced undergraduate and graduate students in mathematics, engineering and computer science, and an inspiring read for all researchers interested in new developments in fuzzy logic and applied mathematics.

The articles appeared in this book have been contributed by well-known mathematician and scientists projecting the modern development in the subject. This book covers the following topics Geometry Algebra Functional Analysis Fuzzy Topology Complex Analysis Tribology Postgraduates and researchers working in the areas of mathematics and mathematical sciences will find this book to be of immense value.

Lotfi Zadeh introduced the notion of a fuzzy subset of a set in 1965. His seminal paper has opened up new insights and applications in a wide range of scientific fields. Arie Rosenfeld used the notion of a fuzzy subset to put forth cornerstone papers in several areas of mathematics, among other disciplines. Rosenfeld is the father of fuzzy abstract algebra. Kuroki is responsible for much of fuzzy ideal theory of semigroups. Others who worked on fuzzy semigroup theory, such as Xie, are mentioned in the bibliography. The purpose of this book is to present an up

to date account of fuzzy subsemigroups and fuzzy ideals of a semigroup. We concentrate mainly on theoretical aspects, but we do include applications. The applications are in the areas of fuzzy coding theory, fuzzy finite state machines, and fuzzy languages. An extensive account of fuzzy automata and fuzzy languages is given in [100]. Consequently, we only consider results in these areas that have not appeared in [100] and that pertain to semigroups. In Chapter 1, we review some basic results on fuzzy subsets, semigroups, codes, finite state machines, and languages. The purpose of this chapter is to present basic results that are needed in the remainder of the book. In Chapter 2, we introduce certain fuzzy ideals of a semigroup, namely, fuzzy two-sided ideals, fuzzy bi-ideals, fuzzy interior ideals, fuzzy quasi ideals, and fuzzy generalized bi-ideals.

A modern introduction to the Poisson process, with general point processes and random measures, and applications to stochastic geometry. A comprehensive and rigorous introduction for graduate students and researchers, with applications in sequential decision-making problems. This book discusses recent developments and the latest research in algebra and related topics. The book allows aspiring researchers to update their understanding of prime rings, generalized derivations, generalized semiderivations, regular semigroups, completely simple semigroups, module hulls, injective hulls, Baer modules, extending modules, local cohomology modules, orthogonal lattices, Banach algebras, multilinear polynomials, fuzzy ideals, Laurent power series, and Hilbert functions. All the contributing authors are leading international academicians and researchers in their respective fields. Most of the papers were presented at the international conference on Algebra and its Applications (ICAA-2014), held at Aligarh Muslim University, India, from December 15–17, 2014. The book also includes papers from mathematicians who couldn't attend the conference. The conference has emerged as a powerful forum offering researchers a venue to meet and discuss advances in algebra and its applications, inspiring further research directions.

Issues in Artificial Intelligence, Robotics and Machine Learning: 2013 Edition ScholarlyEditions

This revised edition discusses numerical methods for computing eigenvalues and eigenvectors of large sparse matrices. It provides an in-depth view of the numerical methods that are applicable for solving matrix eigenvalue problems that arise in various engineering and scientific applications. Each chapter was updated by shortening or deleting outdated topics, adding topics of more recent interest, and adapting the Notes and References section. Significant changes have been made to Chapters 6 through 8, which describe algorithms and their implementations and now include topics such as the implicit restart techniques, the Jacobi-Davidson method, and automatic multilevel substructuring.

This book introduces the study of knots, providing insights into recent applications in DNA research and graph theory. It sets forth fundamental facts such as knot diagrams, braid representations, Seifert surfaces, tangles, and Alexander polynomials. It also covers more recent developments and special topics, such as chord diagrams and covering spaces. The author avoids advanced mathematical terminology and intricate techniques in algebraic topology and group theory. Numerous diagrams and exercises help readers understand and apply the theory. Each chapter includes a supplement with interesting historical and mathematical comments.

The first edition of this book has established itself as one of the leading references on generalized additive models (GAMs), and the only book on the topic to be introductory in nature with a wealth of practical examples and software implementation. It is self-contained, providing the necessary background in linear models, linear mixed models, and generalized linear models (GLMs), before presenting a balanced treatment of the theory and applications of GAMs and related models. The author bases his approach on a framework of penalized regression splines, and while firmly focused on the practical aspects of GAMs, discussions include fairly full explanations of the theory underlying the methods. Use of R software helps explain the theory and illustrates the practical application of the methodology. Each chapter contains an extensive set of exercises, with solutions in an appendix or in the book's R data package `gamair`, to enable use as a course text or for self-study. Simon N. Wood is a professor of Statistical Science at the University of Bristol, UK, and author of the R package `mgcv`.

This book presents the latest advances in applying fuzzy sets and operations research technology and methods. It is the first fuzzy mathematics textbook for students in high school and technical secondary schools. Part of Springer's book series: Advances in Intelligent and Soft Computing, it includes the 36 best papers from the Ninth International Conference on Fuzzy Information and Engineering (ICFIE2017), organized by the Fuzzy Information and Engineering Branch of Operations Research Society of China and Operations Research Society of Guangdong Province in China. Every paper has been carefully peer-reviewed by leading experts. The areas covered include 1. Fuzzy Measure and Integral; 2. Fuzzy Topology and Algebras; 3. Classification and Recognition; 4. Control and Fuzziness; 5. Extension of Fuzzy Set and System; 6. Operations Research and Management (OR); The book is suitable for college, masters and doctoral students; educators in universities, colleges, middle and primary schools teaching mathematics, fuzzy sets and systems, operations research, information and engineering, as well as management, control. Discussing case applications, it is also a valuable reference resource for professionals interested in theoretical and practical research.

The 150th anniversary of the discovery of the famous Neanderthal fossils gave reason for an international and interdisciplinary symposium in Bonn/Germany. The present book arose from this congress and focuses on multiple aspects of archaeological investigation on Neanderthal lifeways. In-depth studies of top-ranking scientists provide a detailed and comprehensive survey of contemporary research on our Pleistocene relatives. Examinations and debates are embedded in a variety of regions and time frames. Chronology, subsistence, land use, and cultural adaptations among late Neanderthals form the major trajectories of the book. The wide range of approaches involved, leads to an increasing understanding of the facets of and the variability of Neanderthal behavioural patterns. The present volume is complemented by a paleontologically orientated publication of the same congress (edited by Gerd-Christian Weniger and Silvana Condemi).

Algebraic topology is a basic part of modern mathematics, and some knowledge of this area is indispensable for any advanced work relating to geometry, including topology itself, differential geometry, algebraic geometry, and Lie groups. This book provides a detailed treatment of algebraic topology both for teachers of the subject and for advanced graduate students in mathematics either specializing in this area or continuing on to other fields. J. Peter May's approach reflects the enormous internal developments within algebraic topology over the past several decades, most of which are largely unknown to mathematicians in other fields. But he also retains the classical presentations of various topics where appropriate. Most chapters end with problems that further explore and refine the concepts presented. The final four chapters provide sketches of substantial areas of algebraic topology that are normally omitted from introductory texts, and the book concludes with a list of suggested readings for those interested in delving further into the field.

"The Guide, in Part I, begins with a brief description of generalized CEA and how it relates to the two questions raised above. It then considers issues relating to study design, estimating costs, assessing health effects, discounting, uncertainty and sensitivity

analysis, and reporting results. Detailed discussions of selected technical issues and applications are provided in a series of background papers, originally published in journals, but included in this book for easy reference in Part II." (from the back cover). Many texts are excellent sources of knowledge about individual statistical tools, but the art of data analysis is about choosing and using multiple tools. Instead of presenting isolated techniques, this text emphasizes problem solving strategies that address the many issues arising when developing multivariable models using real data and not standard textbook examples. It includes imputation methods for dealing with missing data effectively, methods for dealing with nonlinear relationships and for making the estimation of transformations a formal part of the modeling process, methods for dealing with "too many variables to analyze and not enough observations," and powerful model validation techniques based on the bootstrap. This text realistically deals with model uncertainty and its effects on inference to achieve "safe data mining".

Discover New Methods for Dealing with High-Dimensional Data A sparse statistical model has only a small number of nonzero parameters or weights; therefore, it is much easier to estimate and interpret than a dense model. *Statistical Learning with Sparsity: The Lasso and Generalizations* presents methods that exploit sparsity to help recover the underlying signal in a set of data. Top experts in this rapidly evolving field, the authors describe the lasso for linear regression and a simple coordinate descent algorithm for its computation. They discuss the application of l_1 penalties to generalized linear models and support vector machines, cover generalized penalties such as the elastic net and group lasso, and review numerical methods for optimization. They also present statistical inference methods for fitted (lasso) models, including the bootstrap, Bayesian methods, and recently developed approaches. In addition, the book examines matrix decomposition, sparse multivariate analysis, graphical models, and compressed sensing. It concludes with a survey of theoretical results for the lasso. In this age of big data, the number of features measured on a person or object can be large and might be larger than the number of observations. This book shows how the sparsity assumption allows us to tackle these problems and extract useful and reproducible patterns from big datasets. Data analysts, computer scientists, and theorists will appreciate this thorough and up-to-date treatment of sparse statistical modeling. The notion of Fuzziness stands as one of the really new concepts that have recently enriched the world of Science. Science grows not only through technical and formal advances on one side and useful applications on the other side, but also as consequence of the introduction and assimilation of new concepts in its corpus. These, in turn, produce new developments and applications. And this is what Fuzziness, one of the few new concepts arisen in the XX Century, has been doing so far. This book aims at paying homage to Professor Lotfi A. Zadeh, the "father of fuzzy logic" and also at giving credit to his exceptional work and personality. In a way, this is reflected in the variety of contributions collected in the book. In some of them the authors chose to speak of personal meetings with Lotfi; in others, they discussed how certain papers of Zadeh were able to open for them a new research horizon. Some contributions documented results obtained from the author/s after taking inspiration from a particular idea of Zadeh, thus implicitly acknowledging him. Finally, there are contributions of several "third generation fuzzysists or softies" who were firstly led into the world of Fuzziness by a disciple of Lotfi Zadeh, who, following his example, took care of opening for them a new road in science. Rudolf Seising is Adjoint Researcher at the European Centre for Soft Computing in Mieres, Asturias (Spain). Enric Trillas and Claudio Moraga are Emeritus Researchers at the European Centre for Soft Computing, Mieres, Asturias (Spain). Settimo Termini is Professor of Theoretical Computer Science at the University of Palermo, Italy and Affiliated Researcher at the European Centre for Soft Computing, Mieres, Asturias (Spain)

A valuable new edition of a standard reference The use of statistical methods for categorical data has increased dramatically, particularly for applications in the biomedical and social sciences. *An Introduction to Categorical Data Analysis, Third Edition* summarizes these methods and shows readers how to use them using software. Readers will find a unified generalized linear models approach that connects logistic regression and loglinear models for discrete data with normal regression for continuous data. Adding to the value in the new edition is: • Illustrations of the use of R software to perform all the analyses in the book • A new chapter on alternative methods for categorical data, including smoothing and regularization methods (such as the lasso), classification methods such as linear discriminant analysis and classification trees, and cluster analysis • New sections in many chapters introducing the Bayesian approach for the methods of that chapter • More than 70 analyses of data sets to illustrate application of the methods, and about 200 exercises, many containing other data sets • An appendix showing how to use SAS, Stata, and SPSS, and an appendix with short solutions to most odd-numbered exercises Written in an applied, nontechnical style, this book illustrates the methods using a wide variety of real data, including medical clinical trials, environmental questions, drug use by teenagers, horseshoe crab mating, basketball shooting, correlates of happiness, and much more. *An Introduction to Categorical Data Analysis, Third Edition* is an invaluable tool for statisticians and biostatisticians as well as methodologists in the social and behavioral sciences, medicine and public health, marketing, education, and the biological and agricultural sciences. The huge number and broad range of the existing and potential applications of fuzzy logic have precipitated a veritable avalanche of books published on the subject. Most, however, focus on particular areas of application. Many do no more than scratch the surface of the theory that holds the power and promise of fuzzy logic. *Fuzzy Automata and Languages: Theory and Applications* offers the first in-depth treatment of the theory and mathematics of fuzzy automata and fuzzy languages. After introducing background material, the authors study max-min machines and max-product machines, developing their respective algebras and exploring properties such as equivalences, homomorphisms, irreducibility, and minimality. The focus then turns to fuzzy context-free grammars and languages, with special attention to trees, fuzzy dendrolanguage generating systems, and normal forms. A treatment of algebraic fuzzy automata theory follows, along with additional results on fuzzy languages, minimization of fuzzy automata, and recognition of fuzzy languages. Although the book is theoretical in nature, the authors also discuss applications in a variety of fields, including databases, medicine, learning systems, and pattern recognition. Much of the information on fuzzy languages is new and never before presented in book form. *Fuzzy Automata and Languages* incorporates virtually all of the important material published thus far. It stands alone as a complete reference on the subject and belongs on the shelves of anyone interested in fuzzy mathematics or its applications.

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