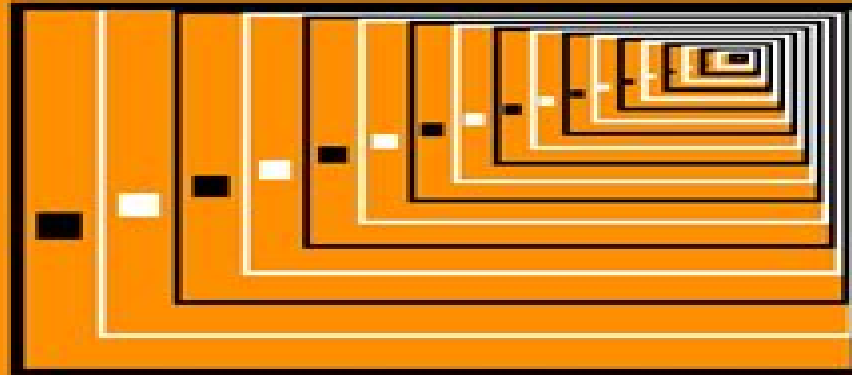


Malik Magdon-Ismail

# DISCRETE MATHEMATICS & COMPUTING

A SET OF LECTURES



# Discrete Mathematics For Computing

**L Cohen**



## **Discrete Mathematics For Computing:**

Discrete Mathematics for Computer Science Jon Pierre Fortney, 2020-12-23 Discrete Mathematics for Computer Science An Example Based Introduction is intended for a first or second year discrete mathematics course for computer science majors It covers many important mathematical topics essential for future computer science majors such as algorithms number representations logic set theory Boolean algebra functions combinatorics algorithmic complexity graphs and trees Features Designed to be especially useful for courses at the community college level Ideal as a first or second year textbook for computer science majors or as a general introduction to discrete mathematics Written to be accessible to those with a limited mathematics background and to aid with the transition to abstract thinking Filled with over 200 worked examples boxed for easy reference and over 200 practice problems with answers Contains approximately 40 simple algorithms to aid students in becoming proficient with algorithm control structures and pseudocode Includes an appendix on basic circuit design which provides a real world motivational example for computer science majors by drawing on multiple topics covered in the book to design a circuit that adds two eight digit binary numbers Jon Pierre Fortney graduated from the University of Pennsylvania in 1996 with a BA in Mathematics and Actuarial Science and a BSE in Chemical Engineering Prior to returning to graduate school he worked as both an environmental engineer and as an actuarial analyst He graduated from Arizona State University in 2008 with a PhD in Mathematics specializing in Geometric Mechanics Since 2012 he has worked at Zayed University in Dubai This is his second mathematics textbook

**Discrete Mathematics for Computing** John E. Munro, 1992-07 DSP System Design presents the investigation of special type of IIR polyphase filter structures combined with frequency transformation techniques used for fast multi rate filtering and their application for custom fixed point implementation Detailed theoretical analysis of the polyphase IIR structure has been presented for two and three coefficients in the two path arrangement This was then generalized for arbitrary filter order and any number of paths The use of polyphase IIR structures in decimation and interpolation is being presented and performance assessed in terms of the number of calculations required for the given filter specification and the simplicity of implementation Specimen decimation filter designs to be used in Sigma Delta lowpass and bandpass A D converters are presented which prove to outperform other traditional approaches New frequency transformation types have been suggested for both real and complex situations A new exact multi point frequency transformation approach for arbitrary frequency choice has been suggested and evaluated Applying such transformations to the existing filter allows to change their frequency response in an intuitive manner without the need of re designing them thus simplifying the designer s job when the specification changes during the prototyping and testing A new bit flipping algorithm has been developed to aid in filter design where the coefficient word length is constraint Also the standard Downhill Simplex Method floating point was modified to operate with the constrained coefficient word length Performance of both these advances is being evaluated on a number of filter cases Novel decimation and interpolation

structures have been proposed which can be implemented very efficiently. These allow an arbitrary order IIR anti aliasing filter to operate at the lower rate of the decimator interpolator. Similar structures for polyphase IIR decimator interpolator structures are being discussed too. A new approach to digital filter design and implementation has been suggested which speeds up silicon implementation of designs developed in Matlab. The Simulink block description is converted automatically into a bit to bit equivalent VHDL description. This in turn can be compiled simulated synthesized and fabricated without the need to go through the design process twice first algorithmic structural design and then the implementation. The book is full of design and analysis techniques. It contains sufficient introductory material enabling non expert readers to understand the material given in it. DSP System Design may be of interest to graduate students researchers and professionals circuit designers who would require fast and low complexity digital filters for both single and multi rate applications especially those with low power specification.

**Discrete Mathematics for Computing** Andrew Vince, Claire Morris, 1990. This text is suitable for an introductory course in the mathematics related to computing generally referred to as discrete mathematics. Topics covered include set theory logic and methods of proof graphs digraphs and trees number systems and matrix algebra and an introduction to binary codes. Throughout the book the interrelations between the mathematical structures and their representations is stressed and use is made of action diagrams as a language independent means of presenting algorithmic processes. Readers who work through this text will acquire the mathematical knowledge and approach to problem solving required by introductory computing courses and a sound bases from which to pursue the subject further.

**Discrete Mathematics Using a Computer** John O'Donnell, Cordelia Hall, Rex Page, 2009-10-12. Computer science abounds with applications of discrete mathematics yet students of computer science often study discrete mathematics in the context of purely mathematical applications. They have to figure out for themselves how to apply the ideas of discrete mathematics to computing problems. It is not easy. Most students fail to experience broad success in this enterprise which is not surprising since many of the most important advances in science and engineering have been precisely applications of mathematics to science and engineering problems. To be sure most discrete math textbooks incorporate some aspects applying discrete math to computing but it usually takes the form of asking students to write programs to compute the number of three ball combinations there are in a set of ten balls or at best to implement a graph algorithm. Few texts ask students to use mathematical logic to analyze properties of digital circuits or computer programs or to apply the set theoretic model of functions to understand higher order operations. A major aim of this text is to integrate tightly the study of discrete mathematics with the study of central problems of computer science.

*Discrete Mathematics for Computing* Peter Grossman, 2017-09-16. Discrete Mathematics for Computing presents the essential mathematics needed for the study of computing and information systems. The subject is covered in a gentle and informal style but without compromising the need for correct methodology. It is perfect for students with a limited background in mathematics. This new edition includes An

expanded section on encryption Additional examples of the ways in which theory can be applied to problems in computing Many more exercises covering a range of levels from the basic to the more advanced This book is ideal for students taking a one semester introductory course in discrete mathematics particularly for first year undergraduates studying Computing and Information Systems PETER GROSSMAN has worked in both academic and industrial roles as a mathematician and computing professional As a lecturer in mathematics he was responsible for coordinating and developing mathematics courses for Computing students He has also applied his skills in areas as diverse as calculator design irrigation systems and underground mine layouts He lives and works in Melbourne Australia

**Discrete Mathematics for Computer Science**

David Liben-Nowell,2017-09-05 Written exclusively with computer science students in mind Discrete Mathematics for Computer Science provides a comprehensive treatment of standard course topics for the introductory discrete mathematics course with a strong emphasis on the relationship between the concepts and their application to computer science The book has been crafted to enhance teaching and learning ease and includes a wide selection of exercises detailed exploration problems examples and problems inspired by wide ranging applications of computer science and handy quick reference guides for key technical topics throughout Discrete Mathematics for Computer Science provides a lucidly written introduction to discrete mathematics with abundant support for learning including over 450 examples thorough chapter summaries simple quizzes and approximately 1600 homework exercises of widely varying difficulty Each chapter begins with motivational content that relates the chapter topic to computer science practice and the book also includes over fifty Computer Science Connections which discuss applications to computer science such as Rotation Matrices Game Trees Logic and Winning Tic Tac Toe Moore s Law Secret Sharing The Enigma Machine and the First Computer Bayesian Modeling and Spam Filtering and Quantum Computing

*Fundamentals of Discrete Math for Computer Science* Tom Jenkyns,Ben Stephenson,2018-05-03 This clearly written textbook presents an accessible introduction to discrete mathematics for computer science students offering the reader an enjoyable and stimulating path to improve their programming competence The text empowers students to think critically to be effective problem solvers to integrate theory and practice and to recognize the importance of abstraction Its motivational and interactive style provokes a conversation with the reader through a questioning commentary and supplies detailed walkthroughs of several algorithms This updated and enhanced new edition also includes new material on directed graphs and on drawing and coloring graphs in addition to more than 100 new exercises with solutions to selected exercises Topics and features assumes no prior mathematical knowledge and discusses concepts in programming as and when they are needed designed for both classroom use and self study presenting modular and self contained chapters that follow ACM curriculum recommendations describes mathematical processes in an algorithmic manner often supported by a walkthrough demonstrating how the algorithm performs the desired task includes an extensive set of exercises throughout the text together with numerous examples and shaded boxes highlighting key

concepts selects examples that demonstrate a practical use for the concept in question Students embarking on the start of their studies of computer science will find this book to be an easy to understand and fun to read primer ideal for use in a mathematics course taken concurrently with their first programming course

Discrete Mathematics for Computing Rod Haggarty,2014 **Discrete Mathematics for Computer Science** Kenneth Bogart, Clifford Stein, Robert L. Drysdale,2005-09-08 Discrete Mathematics for Computer Science is the perfect text to combine the fields of mathematics and computer science Written by leading academics in the field of computer science readers will gain the skills needed to write and understand the concept of proof This text teaches all the math with the exception of linear algebra that is needed to succeed in computer science The book explores the topics of basic combinatorics number and graph theory logic and proof techniques and many more Appropriate for large or small class sizes or self study for the motivated professional reader Assumes familiarity with data structures Early treatment of number theory and combinatorics allow readers to explore RSA encryption early and also to encourage them to use their knowledge of hashing and trees from CS2 before those topics are covered in this course *Discrete Mathematics for Computing* Rod Haggarty,2002 A concise introduction to key mathematical ideas for computing students which develops their understanding of discrete mathematics and its application in computing The topics are presented in a logical order that build upon each other and are constantly reinforced by worked examples Reliance on students previous mathematical experience is kept to a minimum though some basic algebraic manipulation is required Discrete Mathematics For Computer Scientists Stein Clifford,2010-09 *Discrete Mathematics for Computer Scientists* J. K. Truss,1999 This is a new edition of a successful introduction to discrete mathematics for computer scientists updated and reorganised to be more appropriate for the modern day undergraduate audience Discrete mathematics forms the theoretical basis for computer science and this text combines a rigorous approach to mathematical concepts with strong motivation of these techniques via practical examples Key Features Thorough coverage of all area of discrete mathematics including logic natural numbers coding theory combinatorics sets algebraic functions partially ordered structures graphs formal machines complexity theory Special emphasis on the central role of propositional predicate logic Full chapters on algorithm analysis complexity theory Introductory coverage of formal machines coding theory Over 700 exercises Flexible structure so that the material can be easily adapted for different teaching styles New to this Edition Improved treatment of induction Coverage of more basic algebra List of symbols including page references for definition explanation Modern text design and new exercises to aid student comprehension 0201360616B04062001 **Foundation Discrete Mathematics for Computing** D. J. Both,2014-09-01 **Discrete Math for Computer Science Students** Stahl Zsolt,2016-08-28 Discrete Mathematics for Computer Science Students emphasizes mathematical definitions and proofs as well as applicable methods Topics include formal logic notation proof methods induction well ordering sets relations elementary graph theory integer congruences asymptotic notation and growth of functions permutations and combinations

counting principles discrete probability Further selected topics may also be covered such as recursive definition and structural induction state machines and invariants recurrences generating functions

**Lectures On Discrete Mathematics For Computer Science** Bakhadyr M Khoussainov, Nodira Khoussainova, 2012-03-21 This textbook presents fundamental topics in discrete mathematics introduced from the perspectives of a pure mathematician and an applied computer scientist The synergy between the two complementary perspectives is seen throughout the book key concepts are motivated and explained through real world examples and yet are still formalized with mathematical rigor The book is an excellent introduction to discrete mathematics for computer science software engineering and mathematics students The first author is a leading mathematician in the area of logic computability and theoretical computer science with more than 25 years of teaching and research experience The second author is a computer science PhD student at the University of Washington specializing in database systems The father and daughter team merges two different views to create a unified book for students interested in learning discrete mathematics the connections between discrete mathematics and computer science and the mathematical foundations of computer science Readers will learn how to formally define abstract concepts reason about objects such as programs graphs and numbers investigate properties of algorithms and prove their correctness The textbook studies several well known algorithmic problems including the path problem for graphs and finding the greatest common divisor inductive definitions proofs of correctness of algorithms via loop invariants and induction the basics of formal methods such as propositional logic finite state machines counting probability as well as the foundations of databases such as relational calculus

**Essential Discrete Mathematics for Computer Science** Harry Lewis, 2013

**Essential Discrete Mathematics for Computer Science** Todd Feil, Joan Krone, 2003 This book introduces readers to the mathematics of computer science and prepares them for the math they will encounter in other college courses It includes applications that are specific to computer science helps learners to develop reasoning skills and provides the fundamental mathematics necessary for computer scientists Chapter topics include sets functions and relations Boolean algebra natural numbers and induction number theory recursion solving recurrences counting matrices and graphs For computer scientists and the enhancement of programming skills

Guide to Discrete Mathematics Gerard O'Regan, 2021-10-28 This stimulating textbook presents a broad and accessible guide to the fundamentals of discrete mathematics highlighting how the techniques may be applied to various exciting areas in computing The text is designed to motivate and inspire the reader encouraging further study in this important skill Features This book provides an introduction to the building blocks of discrete mathematics including sets relations and functions describes the basics of number theory the techniques of induction and recursion and the applications of mathematical sequences series permutations and combinations presents the essentials of algebra explains the fundamentals of automata theory matrices graph theory cryptography coding theory language theory and the concepts of computability and decidability reviews the history of logic discussing propositional and predicate logic as

well as advanced topics such as the nature of theorem proving examines the field of software engineering including software reliability and dependability and describes formal methods investigates probability and statistics and presents an overview of operations research and financial mathematics

*Mathematics of Discrete Structures for Computer Science* Gordon J. Pace, 2012-07-09 Mathematics plays a key role in computer science some researchers would consider computers as nothing but the physical embodiment of mathematical systems And whether you are designing a digital circuit a computer program or a new programming language you need mathematics to be able to reason about the design its correctness robustness and dependability This book covers the foundational mathematics necessary for courses in computer science The common approach to presenting mathematical concepts and operators is to define them in terms of properties they satisfy and then based on these definitions develop ways of computing the result of applying the operators and prove them correct This book is mainly written for computer science students so here the author takes a different approach he starts by defining ways of calculating the results of applying the operators and then proves that they satisfy various properties After justifying his underlying approach the author offers detailed chapters covering propositional logic predicate calculus sets relations discrete structures structured types numbers and reasoning about programs The book contains chapter and section summaries detailed proofs and many end of section exercises key to the learning process The book is suitable for undergraduate and graduate students and although the treatment focuses on areas with frequent applications in computer science the book is also suitable for students of mathematics and engineering

**Discrete Mathematics and Computing** Malik Magdon-Ismael, 2019-12-14 This text is a semester course in the basic mathematical and theoretical foundations of computer science Students who make heavy use of computing should learn these foundations well setting a base for a follow on course in algorithms A solid theoretical and algorithmic foundation in computer science sets the stage for developing good programs programs that work always and efficiently Each chapter is a lecture that has been taught as such Part I starts with basic logic proofs and discrete mathematics including induction recursion summation asymptotics and number theory We then continue with graphs counting and combinatorics and wrap up the coverage of discrete mathematics with discrete probability Part II presents the blockbuster application of discrete mathematics the digital computer and a theory of computing The goal is to understand what a computer can and cannot do We start small with automata and end big with Turing Machines Our approach is Socratic The reader is encouraged to participate actively in the learning process by doing the quizzes and exercises that are liberally sprinkled through the text The pace and level is appropriate for readers with one year of training in programming and calculus college sophomores

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