

Integer Point Enumeration In Polyhedra

The second Women in Numbers workshop (WIN2) was held November 6-11, 2011, at the Banff International Research Station (BIRS) in Banff, Alberta, Canada. During the workshop, group leaders presented open problems in various areas of number theory, and working groups tackled those problems in collaborations begun at the workshop and continuing long after. This volume collects articles written by participants of WIN2. Survey papers written by project leaders are designed to introduce areas of active research in number theory to advanced graduate students and recent PhDs. Original research articles by the project groups detail their work on the open problems tackled during and after WIN2. Other articles in this volume contain new research on related topics by women number theorists. The articles collected here encompass a wide range of topics in number theory including Galois representations, the Tamagawa number conjecture, arithmetic intersection formulas, Mahler measures, Newton polygons, the Dwork family, elliptic curves, cryptography, and supercongruences. WIN2 and this Proceedings volume are part of the Women in Numbers network, aimed at increasing the visibility of women researchers' contributions to number theory and at increasing the participation of women mathematicians in number theory and related fields. This book is co-published with the Centre de Recherches Mathématiques.

This volume is dedicated to the memory of Shoshichi Kobayashi, and gathers contributions from distinguished researchers working on topics close to his research areas. The book is organized into three parts, with the first part presenting an overview of Professor Shoshichi Kobayashi's career. This is followed by two expository course lectures (the second part) on recent topics in extremal Kähler metrics and value distribution theory, which will be helpful for graduate students in mathematics interested in new topics in complex geometry and complex analysis. Lastly, the third part of the volume collects authoritative research papers on differential geometry and complex analysis. Professor Shoshichi Kobayashi was a recognized international leader in the areas of differential and complex geometry. He contributed crucial ideas that are still considered fundamental in these fields. The book will be of interest to researchers in the fields of differential geometry, complex geometry, and several complex variables geometry, as well as to graduate students in mathematics.

This richly illustrated textbook explores the amazing interaction between combinatorics, geometry, number theory, and analysis which arises in the interplay between polyhedra and lattices. Highly accessible to advanced undergraduates, as well as beginning graduate students, this second edition is perfect for a capstone course, and adds two new chapters, many new exercises, and updated open problems. For scientists, this text can be utilized as a self-contained tooling device. The topics include a friendly invitation to Ehrhart's theory of counting lattice points in polytopes, finite Fourier analysis, the Frobenius coin-exchange problem, Dedekind sums, solid angles, Euler–Maclaurin summation for polytopes, computational geometry, magic squares, zonotopes, and more. With more than 300 exercises and open research problems, the reader is an active participant, carried through diverse but tightly woven mathematical fields that are inspired by an innocently elementary question: What are the relationships between the continuous volume of a polytope and its discrete volume? Reviews of the first edition: “You owe it to yourself to pick up a copy of Computing the Continuous Discretely to read about a number of interesting problems in geometry, number theory, and combinatorics.” — MAA Reviews “The book is written as an accessible and engaging textbook, with many examples, historical notes, pithy quotes, commentary integrating the mate rial, exercises, open problems and an extensive bibliography.” — Zentralblatt MATH “This beautiful book presents, at a level suitable for advanced undergraduates, a fairly complete introduction to the problem of counting lattice points inside a convex polyhedron.” — Mathematical Reviews “Many departments recognize the need for capstone courses in which graduating students can see the tools they have acquired come together in some satisfying way. Beck and Robins have written the perfect text for such a course.” — CHOICE

????A memorial conference for Leon Ehrenpreis was held at Temple University, November 15-16, 2010. In the spirit of Ehrenpreis's contribution to mathematics, the papers in this volume, written by prominent mathematicians, represent the wide breadth of subjects that Ehrenpreis traversed in his career, including partial differential equations, combinatorics, number theory, complex analysis and a bit of applied mathematics. With the exception of one survey article, the papers in this volume are all new results in the various fields in which Ehrenpreis worked . There are papers in pure analysis, papers in number theory, papers in what may be called applied mathematics such as population biology and parallel refractors and papers in partial differential equations. The mature mathematician will find new mathematics and the advanced graduate student will find many new ideas to explore.??A biographical sketch of Leon Ehrenpreis by his daughter, a professional journalist, enhances the memorial tribute and gives the reader a glimpse into the life and career of a great mathematician.

This two-volume set of LNCS 7965 and LNCS 7966 constitutes the refereed proceedings of the 40th International Colloquium on Automata, Languages and Programming, ICALP 2013, held in Riga, Latvia, in July 2013. The total of 124 revised full papers presented were carefully reviewed and selected from 422 submissions.

They are organized in three tracks focussing on algorithms, complexity and games; logic, semantics, automata and theory of programming; and foundations of networked computation.

"An introduction to the theory and practice of abstract interpretation, with applications to the semantics, specification, verification, and static analysis of computer programs"--

This textbook illuminates the field of discrete mathematics with examples, theory, and applications of the discrete volume of a polytope. The authors have weaved a unifying thread through basic yet deep ideas in discrete geometry, combinatorics, and number theory. We encounter here a friendly invitation to the field of "counting integer points in polytopes", and its various connections to elementary finite Fourier analysis, generating functions, the Frobenius coin-exchange problem, solid angles, magic squares, Dedekind sums, computational geometry, and more. With 250 exercises and open problems, the reader feels like an active participant.

This book constitutes the refereed proceedings of the 19th International Conference on Integer Programming and Combinatorial Optimization, IPCO 2017, held in Waterloo, IN, Canada, in June 2017. The 36 full papers presented were carefully reviewed and selected from 125 submissions. The conference is a forum for researchers and practitioners working on various aspects of integer programming and combinatorial optimization. The aim is to present recent developments in theory, computation, and applications in these areas. The scope of IPCO is viewed in a broad sense, to include algorithmic and structural results in integer programming and combinatorial optimization as well as revealing computational studies and novel applications of discrete optimization to practical problems.

[Euroconference in Mathematics : Algebraic and Geometric Combinatorics, August 20-26, 2005, Anogia, Crete, Greece](#)

[Principles of Abstract Interpretation](#)

[Local Binary Patterns: New Variants and Applications](#)

[Resources for Teaching Discrete Mathematics](#)

[Classroom Projects, History Modules, and Articles](#)

[Integer Programming and Combinatorial Optimization](#)

[Exercises in \(Mathematical\) Style](#)

[The Challenges of Non-linear Parameters and Variables in Automatic Loop Parallelisation](#)

[Women in Numbers 2: Research Directions in Number Theory](#)

[40th International Colloquium, ICALP 2013, Riga, Latvia, July 8-12, 2013, Proceedings](#)

[Algebraic and Geometric Methods in Discrete Mathematics](#)

[Formal Modeling and Analysis of Timed Systems](#)

Famous mathematical constants include the ratio of circular circumference to diameter, $\pi = 3.14 \dots$, and the natural logarithm base, $e = 2.178 \dots$. Students and professionals can often name a few others, but there are many more buried in the literature and awaiting discovery. How do such constants arise, and why are they important? Here are 133 essays that broaden the landscape. Topics include the minimality of soap film surfaces, prime numbers, elliptic curves and modular forms, Poisson-Voronoi tessellations, random triangles, Brownian motion, uncertainty inequalities, Prandtl-Blausius flow (from fluid dynamics), Lyapunov exponents, knots and tangle capacitance (from potential theory), Zermelo's navigation problem, and the optimal control of a pendulum. Unsolved problems appear virtually everywhere as well. This volume continues an outstanding scholarly attempt to bring together all significant mathematical constants in one place.

The AMS-IMS-SIAM Joint Summer Research Conference ``Integer Points in Polyhedra--Geometry, Number Theory, Representation Theory, Algebra, Optimization, Statistics" was held in Snowbird, Utah in June 2006. This proceedings volume contains research and survey articles originating from the conference. The volume is a cross section of the talks given at the conference, topics range from commutative algebra to optimization, from discrete geometry to statistics, from mirror symmetry to geometry of numbers. The book is suitable for researchers and graduate students interested in combinatorial aspects of the above fields.

This book introduces Local Binary Patterns (LBP), arguably one of the most powerful texture descriptors, and LBP variants. This volume provides the latest reviews of the literature and a presentation of some of the best LBP variants by researchers at the forefront of textual analysis research and research on LBP descriptors and variants. It uses many databases representing a diversity of computer vision applications in medicine, biometrics, and other areas. There is also a chapter that provides an excellent theoretical foundation for texture analysis and LBP in particular. A special section focuses on LBP and LBP variants in the area of face recognition, including thermal face recognition as well as to those interested in learning more about this powerful family of texture descriptors.

With the rise of manycore processors, parallelism is becoming a mainstream necessity. Unfortunately, parallel programming is inherently more difficult than sequential programming; therefore, techniques for automatic parallelisation will become indispensable. This doctoral thesis aims at extending the well-known polyhedron model, which provides a simple and efficient way to express parallel programs. Up to now, loop bounds and array subscripts in the modelled codes must be expressions linear in both the variables and the parameters. This restriction is lifted to allow certain polynomial expressions instead of linear ones. With these extensions, more programs can be handled in dependence analysis, in the transformation of the program to a form amenable to parallelisation, and in the generation of parallel code. What does style mean in mathematics? Style is both how one does something and how one communicates what was done. In this book, the author investigates the worlds of the well-known numbers, the binomial coefficients. The author follows the example of Raymond Queneau's Exercises in Style. Offering the reader 99 stories in various guises, the author explores the rich properties of this familiar collection of numbers. For any one interested in mathematics, from high school students on up.

The AMS-IMS-SIAM Summer Research Conference on Integer Points in Polyhedra took place in Snowbird (UT). This proceedings volume contains original research and survey articles stemming from that event. Topics covered include commutative algebra, optimization, discrete geometry, statistics, representation theory, and symplectic geometry. This volume contains original research and survey articles stemming from that event. Topics covered include commutative algebra, optimization, discrete geometry, statistics, representation theory, and symplectic geometry. This volume contains original research and survey articles stemming from that event. Topics covered include commutative algebra, optimization, discrete geometry, statistics, representation theory, and symplectic geometry.

This book is based on a 10-day workshop given by leading experts in hyperbolic geometry, quantum topology and number theory, in June 2009 at Columbia University. Each speaker gave a minicourse consisting of three or four lectures aimed at graduate students and recent PhDs. The proceedings of this enormously successful workshop contain expository and broadly accessible to graduate students. Although many ideas overlap, the twelve expository/research papers in this volume can be grouped into four rough categories: (1) different approaches to the Volume Conjecture, and relations between the main quantum and geometric invariants; (2) the geometry associated to the Volume Conjecture; (3) the geometry associated to the Volume Conjecture; (4) quantum invariants associated to knots and hyperbolic 3-manifolds. The workshop, the conference that followed, and these proceedings continue a long tradition in quantum and geometric topology of bringing together ideas from diverse areas of mathematics and physics, and highlights the importance of collaboration in disparate disciplines.

This is a self-contained exposition of several core aspects of the theory of rational polyhedra with a view towards algorithmic applications to efficient counting of integer points, a problem arising in many areas of pure and applied mathematics. The approach is based on the consistent development and application of the apparatus of general linear algebra, classical, such as the Euler characteristic, continued fractions, Ehrhart polynomial, Minkowski Convex Body Theorem, and the Lenstra-Lenstra-Lovasz lattice reduction algorithm, to recent advances such as the Berline-Vergne local formula. The text is intended for graduate students and researchers. Prerequisites are a modest background in linear algebra and mathematical maturity. Numerous figures, exercises of varying degree of difficulty as well as references to the literature and publicly available software make the text suitable for a graduate course.

[Geometric Combinatorics](#)

[Interactions Between Hyperbolic Geometry, Quantum Topology, and Number Theory](#)

[Combinatorial Reciprocity Theorems: An Invitation to Enumerative Geometric Combinatorics](#)

[Integer Points in Polyhedra-- Geometry, Number Theory, Representation Theory, Algebra, Optimization, Statistics](#)

[AMS-IMS-SIAM Joint Summer Research Conference, June 11-15, 2006, Snowbird, Utah](#)

[23rd International Workshop, CASC 2021, Sochi, Russia, September 13-17, 2021, Proceedings](#)

[In Memory of Leon Ehrenpreis](#)

[9th International Conference, FORMATS 2011, Aalborg, Denmark, September 21-23, 2011, Proceedings](#)

[The Beauty, the Toil and the Method](#)

[In Memory of Professor Shoshichi Kobayashi](#)

[In Honor of Helmut Maier's 60th Birthday](#)

[Existence of Unimodular Triangulations-Positive Results](#)

This book is dedicated to preparing prospective college students for the study of mathematics. It can be used at the end of high school or during the first year of college, for personal study or for introductory courses. It aims to set a meeting between two relatives who rarely speak to each other: the Mathematics of Beauty, which shows up in some popular books and films, and the Mathematics of Toil, which is widely known. Toil can be overcome through an appropriate method of work. Beauty will be found in the achievement of a way of thinking. The first part concerns the mathematical language: the expressions “for all”, “there exists”, “implies”, “is false”, . . .; what is a proof by contradiction; how to use indices, sums, induction. The second part tackles specific difficulties: to study a definition, to understand an idea and apply it, to fix a slightly wrong argument, to discuss suggestions, to explain a proof. The third part presents customary techniques and points of view in college mathematics. The reader can choose one of three difficulty levels (A, B, C).

This volume contains a collection of research and survey papers written by some of the most eminent mathematicians in the international community and is dedicated to Helmut Maier, whose own research has been groundbreaking and deeply influential to the field. Specific emphasis is given to topics regarding exponential and trigonometric sums and their behavior in short intervals, anatomy of integers and cyclotomic polynomials, small gaps in sequences of sifted prime numbers, oscillation theorems for primes in arithmetic progressions, inequalities related to the distribution of primes in short intervals, the Möbius function, Euler’s totient function, the Riemann zeta function and the Riemann Hypothesis. Graduate students, research mathematicians, as well as computer scientists and engineers who are interested in pure and interdisciplinary research, will find this volume a useful resource. Contributors to this volume: Bill Allombert, Levent Alpoge, Nadine Amersî, Yuri Bilu, Régis de la Bretèche, Christian Elsholtz, John B. Friedlander, Kevin Ford, Daniel A. Goldston, Steven M. Gonek, Andrew Granville, Adam J. Harper, Glyn Harman, D. R. Heath-Brown, Aleksandar Ivi?, Geoffrey Iyer, Jerzy Kaczorowski, Daniel M. Kane, Sergei Konyagin, Dimitris Koukoulopoulos, Michel L. Lapidus, Oleg Lazarev, Andrew H. Ledoan, Robert J. Lemke Oliver, Florian Luca, James Maynard, Steven J. Miller, Hugh L. Montgomery, Melvyn B. Nathanson, Ashkan Nikeghbali, Alberto Perelli, Amalia Pizarro-Madariaga, János Pintz, Paul Pollack, Carl Pomerance, Michael Th. Rassias, Maksym Radziwi??, Joël Rivat, András Sárközy, Jeffrey Shallit, Terence Tao, Gérald Tenenbaum, László Tóth, Tamar Ziegler, Liyang Zhang.

Resources for Teaching Discrete Mathematics presents nineteen classroom tested projects complete with student handouts, solutions, and notes to the instructor. Topics range from a first day activity that motivates proofs to applications of discrete mathematics to chemistry, biology, and data storage. Other projects provide: supplementary material on classic topics such as the towers of Hanoi and the Josephus problem, how to use a calculator to explore various course topics, how to employ Cuisenaire rods to examine the Fibonacci numbers and other sequences, and how you can use plastic pipes to create a geodesic dome. The book contains eleven history modules that allow students to explore topics in their original context. Sources range from eleventh century Chinese figures that prompted Leibniz to write on binary arithmetic, to a 1959 article on automata theory. Excerpts include: Pascal’s “Treatise on the Arithmetical Triangle,” Hamilton’s “Account of the Icosian Game,” and Cantor’s (translated) “Contributions to the Founding of the Theory of Transfinite Numbers.” Five articles complete the book. Three address extensions of standard discrete mathematics content: an exploration of historical counting problems with attention to discovering formulas, a discussion of how computers store graphs, and a survey connecting the principle of inclusion-exclusion to Möbius inversion. Finally, there are two articles on pedagogy specifically related to discrete mathematics courses: a summary of adapting a group discovery method to larger classes, and a discussion of using logic in encouraging students to construct proofs.

This volume contains original research and survey articles stemming from the Euroconference “Algebraic and Geometric Combinatorics”. The papers discuss a wide range of problems that illustrate interactions of combinatorics with other branches of mathematics, such as commutative algebra, algebraic geometry, convex and discrete geometry, enumerative geometry, and topology of complexes and partially ordered sets. Among the topics covered are combinatorics of polytopes, lattice polytopes, triangulations and subdivisions, Cohen-Macaulay cell complexes, monomial ideals, geometry of toric surfaces, groupoids in combinatorics, Kazhdan-Lusztig combinatorics, and graph colorings. This book is aimed at researchers and graduate students interested in various aspects of modern combinatorial theories.

Divisors and Sandpiles provides an introduction to the combinatorial theory of chip-firing on finite graphs. Part 1 motivates the study of the discrete Laplacian by introducing the dollar game. The resulting theory of divisors on graphs runs in close parallel to the geometric theory of divisors on Riemann surfaces, and Part 1 culminates in a full exposition of the graph-theoretic Riemann–Roch theorem due to M. Baker and S. Norine. The text leverages the reader’s understanding of the discrete story to provide a brief overview of the classical theory of Riemann surfaces. Part 2 focuses on sandpiles, which are toy models of physical systems with dynamics controlled by the discrete Laplacian of the underlying graph. The text provides a careful introduction to the sandpile group and the abelian sandpile model, leading ultimately to L. Levine’s threshold density theorem for the fixed-energy sandpile Markov chain. In a precise sense, the theory of sandpiles is dual to the theory of divisors, and there are many beautiful connections between the first two parts of the book. Part 3 addresses various topics connecting the theory of chip-firing to other areas of mathematics, including the matrix–tree theorem, harmonic morphisms, parking functions, M–matrices, matroids, the Tutte polynomial, and simplicial homology. The text is suitable for advanced undergraduates and beginning graduate students.

Algebra and number theory have always been counted among the most beautiful mathematical areas with deep proofs and elegant results. However, for a long time they were not considered that important in view of the lack of real-life applications. This has dramatically changed: nowadays we find applications of algebra and number theory frequently in our daily life. This book focuses on the theory and algorithms for polynomials over various coefficient domains such as a finite field or ring. The operations on polynomials in the focus are factorization, composition and decomposition, basis computation for modules, etc. Algorithms for such operations on polynomials have always been a central interest in computer algebra, as it combines formal (the variables) and algebraic or numeric (the coefficients) aspects. The papers presented were selected from the Workshop on Computer Algebra and Polynomials, which was held in Linz at the Johann Radon Institute for Computational and Applied Mathematics (RICAM) during November 25-29, 2013, at the occasion of the Special Semester on Applications of Algebra and Number Theory.

Triangulations presents the first comprehensive treatment of the theory of secondary polytopes and related topics. The text discusses the geometric structure behind the algorithms and shows new emerging applications, including hundreds of illustrations, examples, and exercises.

Geometric combinatorics describes a wide area of mathematics that is primarily the study of geometric objects and their combinatorial structure. This text is a compilation of expository articles at the interface between combinatorics and geometry.

[Polyhedral Computation](#)

[The 3x+1 Problem](#)

[Workshop, June 3-13, 2009, Conference, June 15-19, 2009, Columbia University, New Ork, NY](#)

[19th International Conference, IPCO 2017, Waterloo, ON, Canada, June 26-28, 2017, Proceedings](#)

[Mathematical Constants II](#)

[Computing the Continuous Discretely](#)

[Recent Trends in Algebraic Combinatorics](#)

[Geometry of Continued Fractions](#)

[Integer-point Enumeration in Polyhedra](#)

[Enumerative Combinatorics:](#)

[How to Guard an Art Gallery and Other Discrete Mathematical Adventures](#)

[Studying Mathematics](#)

This book constitutes the refereed proceedings of the 9th International Conference on Formal Modeling and Analysis of Timed Systems, FORMATS 2011, held in Aalborg, Denmark, in September 2011. The 20 revised full papers presented together with three invited talks were carefully reviewed and selected from 43 submissions. The papers are organized in topical sections on probabilistic methods, robustness, games, verification and testing, verification, hybrid systems, and applications.

Richard Stanley's work in combinatorics revolutionized and reshaped the subject. His lectures, papers, and books inspired a generation of researchers. In this volume, these researchers explain how Stanley's vision and insights influenced and guided their own perspectives on the subject. As a valuable bonus, this book contains a collection of Stanley's short comments on each of his papers. This book may serve as an introduction to several different threads of ongoing research in combinatorics as well as giving historical perspective.

Many polytopes of practical interest have enormous output complexity and are often highly degenerate, posing severe difficulties for known general-purpose algorithms. They are, however, highly structured, and attention has turned to exploiting this structure, particularly symmetry. Initial applications of this approach have permitted computations previously far out of reach, but much remains to be understood and validated experimentally. The papers in this volume give a good snapshot of the ideas discussed at a Workshop on Polyhedral Computation held at the CRM in Montreal in October 2006 and, with one exception, the current state of affairs in this area. The exception is the inclusion of an often cited 1980 technical report of Norman Zadeh, which was never published in a journal and has passed into the folklore of the discipline. This paper illustrates beautifully the work still to be done in the field: it gives a simple pivot rule for the simplex method for which it is still unknown if it yields a polynomial time algorithm.

Combinatorics plays a prominent role in contemporary mathematics, due to the vibrant development it has experienced in the last two decades and its many interactions with other subjects. This book arises from the InDAM conference "CoMeTA 2013 - Combinatorial Methods in Topology and Algebra," which was held in Cortona in September 2013. The event brought together emerging and leading researchers at the crossroads of Combinatorics, Topology and Algebra, with a particular focus on new trends in subjects such as: hyperplane arrangements; discrete geometry and combinatorial topology; polytope theory and triangulations of manifolds; combinatorial algebraic geometry and commutative algebra; algebraic combinatorics; and combinatorial representation theory. The book is divided into two parts. The first expands on the topics discussed at the conference by providing additional background and explanations, while the second presents original contributions on new trends in the topics addressed by the conference.

This volume contains the proceedings of the AMS Special Session on Algebraic and Geometric Methods in Applied Discrete Mathematics, held on January 11, 2015, in San Antonio, Texas. The papers present connections between techniques from "pure" mathematics and various applications amenable to the analysis of discrete models, encompassing applications of combinatorics, topology, algebra, geometry, optimization, and representation theory. Papers not only present novel results, but also survey the current state of knowledge of important topics in applied discrete mathematics. Particular highlights include: a new computational framework, based on geometric combinatorics, for structure prediction from RNA sequences; a new method for approximating the optimal solution of a sum of squares problem; a survey of recent Helly-type geometric theorems; applications of representation theory to voting theory and game theory; a study of fixed points of tensors; and exponential random graph models from the perspective of algebraic statistics with applications to networks. This volume was written for those trained in areas such as algebra, topology, geometry, and combinatorics who are interested in tackling problems in fields such as biology, the social sciences, data analysis, and optimization. It may be useful not only for experts, but also for students who wish to gain an applied or interdisciplinary perspective.

The explanations and formulas can be grasped with a basic understanding of linear equations.

This volume is an outcome of the workshop "Moduli of K-stable Varieties", which was held in Rome, Italy in 2017. The content focuses on the existence problem for canonical Kähler metrics and links to the algebro-geometric notion of K-stability. The book includes both surveys on this problem, notably in the case of Fano varieties, and original contributions addressing this and related problems. The papers in the latter group develop the theory of K-stability; explore canonical metrics in the Kähler and almost-Kähler settings; offer new insights into the geometric significance of K-stability; and develop tropical aspects of the moduli space of curves, the singularity theory necessary for higher dimensional moduli theory, and the existence of minimal models. Reflecting the advances made in the area in recent years, the survey articles provide an essential overview of many of the most important findings. The book is intended for all advanced graduate students and researchers who want to learn about recent developments in the theory of moduli space, K-stability and Kähler-Einstein metrics.

Traditionally a subject of number theory, continued fractions appear in dynamical systems, algebraic geometry, topology, and even celestial mechanics. The rise of computational geometry has resulted in renewed interest in multidimensional generalizations of continued fractions. Numerous classical theorems have been extended to the multidimensional case, casting light on phenomena in diverse areas of mathematics. This book introduces a new geometric vision of continued fractions. It covers several applications to questions related to such areas as Diophantine approximation, algebraic number theory, and toric geometry. The reader will find an overview of current progress in the geometric theory of multidimensional continued fractions accompanied by currently open problems. Whenever possible, we illustrate geometric constructions with figures and examples. Each chapter has exercises useful for undergraduate or graduate courses.

[Computer Algebra in Scientific Computing](#)

[Computer Algebra and Polynomials](#)

[Integer Points in Polyhedra --- Geometry, Number Theory, Algebra, Optimization](#)

[Integer-Point Enumeration in Polyhedra](#)

[Analytic Number Theory](#)

[Applications of Algebra and Number Theory](#)

[Topics in Hyperplane Arrangements, Polytopes and Box-Splines](#)

[From Fourier Analysis and Number Theory to Radon Transforms and Geometry](#)

[Moduli of K-stable Varieties](#)

[Automata, Languages, and Programming](#)

[Combinatorial Methods in Topology and Algebra](#)

[Triangulations](#)

This edited volume features a curated selection of research in algebraic combinatorics that explores the boundaries of current knowledge in the field. Focusing on topics experiencing broad interest and rapid growth, invited contributors offer survey articles on representation theory, symmetric functions, invariant theory, and the combinatorics of Young tableaux. The volume also addresses subjects at the intersection of algebra, combinatorics, and geometry, including the study of polytopes, lattice points, hyperplane arrangements, crystal graphs, and Grassmannians. All surveys are written at an introductory level that emphasizes recent developments and open problems. An interactive tutorial on Schubert Calculus emphasizes the geometric and topological aspects of the topic and is suitable for combinatorialists as well as geometrically minded researchers seeking to gain familiarity with relevant combinatorial tools. Featured authors include prominent women in the field known for their exceptional writing of deep mathematics in an accessible manner. Each article in this volume was reviewed independently by two referees. The volume is suitable for graduate students and researchers interested in algebraic combinatorics.

Combinatorial reciprocity is a very interesting phenomenon, which can be described as follows: A polynomial, whose values at positive integers count combinatorial objects of some sort, may give the number of combinatorial objects of a different sort when evaluated at negative integers (and suitably normalized). Such combinatorial reciprocity theorems occur in connections with graphs, partially ordered sets, polyhedra, and more. Using the combinatorial reciprocity theorems as a leitmotif, this book unfolds central ideas and techniques in enumerative and geometric combinatorics. Written in a friendly writing style, this is an accessible graduate textbook with almost 300 exercises, numerous illustrations, and pointers to the research literature. Topics include concise introductions to partially ordered sets, polyhedral geometry, and rational generating functions, followed by highly original chapters on subdivisions, geometric realizations of partially ordered sets, and hyperplane arrangements.

Topics in Hyperplane Arrangements, Polytopes and Box-Splines brings together many areas of research that focus on methods to compute the number of integral points in suitable families or variable polytopes. The topics introduced expand upon differential and difference equations, approximation theory, cohomology, and module theory. This book, written by two distinguished authors, engages a broad audience by proving the a strong foudation. This book may be used in the classroom setting as well as a reference for researchers.

Unimodular triangulations of lattice polytopes arise in algebraic geometry, commutative algebra, integer programming and, of course, combinatorics. In this article, we review several classes of polytopes that do have unimodular triangulations and constructions that preserve their existence. We include, in particular, the first effective proof of the classical result by Knudsen-Mumford-Waterman stating that every lattice polytope has a dilation that admits a unimodular triangulation. Our proof yields an explicit (although doubly exponential) bound for the dilation factor.

"Richard Stanley's two-volume basic introduction to enumerative combinatorics has become the standard guide to the topic for students and experts alike. This thoroughly revised second edition of Volume 1 includes ten new sections and more than 300 new exercises, most with solutions, reflecting numerous new developments since the publication of the first edition in 1986. The author brings the coverage up to date and includes a wide variety of additional applications and examples, as well as updated and expanded chapter bibliographies. Many of the less difficult new exercises have no solutions so that they can more easily be assigned to students. The material on P-partitions has been rearranged and generalized; the treatment of permutation statistics has been greatly enlarged; and there are also new sections on q-analogues of permutations, hyperplane arrangements, the cd-index, promotion and evacuation and differential posets"--

The 3x+1 problem, or Collatz problem, concerns the following seemingly innocent arithmetic procedure applied to integers: If an integer n is odd then "multiply by three and add one", while if it is even then "divide by two". The 3x+1 problem asks whether, starting from any positive integer, repeating this procedure over and over will eventually reach the number 1. Despite its simple appearance, this problem is unsolved. Generalizations of the problem are known to be undecidable, and the problem itself is believed to be extraordinarily difficult. This book reports on what is known on this problem. It consists of a collection of papers, which can be read independently of each other. The book begins with two introductory papers, one giving an overview and current status, and the second giving history and basic results on the problem. These are followed by three survey papers on the problem, relating it to number theory and dynamical systems, to Markov chains and ergodic theory, and to logic and the theory of computation. The next paper presents results on probabilistic models for behavior of the iteration. This is followed by a paper giving the latest computational results on the problem, which verify its truth for $5.4 \cdot 10^{18}$. The book also reprints six early papers on the problem and related questions, by L. Collatz, J. H. Conway, H. S. M. Coxeter, C. J. Everett, and R. K. Guy, each with editorial commentary. The book concludes with an annotated bibliography of work on the problem up to the year 2000.

[Divisors and Sandpiles: An Introduction to Chip-Firing](#)

[Proceedings of an AMS-IMS-SIAM Joint Summer Research Conference on Integer Points in Polyhedra, July 13-17, 2003, Snowbird, Utah](#)

[The Ultimate Challenge](#)

[Structures for Algorithms and Applications](#)

[Algebraic and Geometric Combinatorics](#)

[Geometry and Analysis on Manifolds](#)

[The Mathematical Legacy of Richard P. Stanley](#)

[Integer Points in Polyhedra](#)