allen hatcher algebraic topology

Allen Hatcher Algebraic Topology: A Comprehensive Guide

Introduction:

Are you embarking on the challenging yet rewarding journey of learning algebraic topology? Finding the right resources can make or break your experience. This comprehensive guide focuses on Allen Hatcher's seminal work, "Algebraic Topology," providing a detailed overview of its contents, strengths, weaknesses, and how to effectively utilize it for your studies. We'll delve into its structure, cover key topics, and offer advice for navigating this influential textbook. Whether you're a seasoned mathematician or a newcomer to the field, this post will equip you with the knowledge you need to conquer Hatcher's masterpiece.

I. Understanding Allen Hatcher's "Algebraic Topology"

Allen Hatcher's "Algebraic Topology" is a widely acclaimed textbook that has become a standard reference for both undergraduate and graduate courses. Its popularity stems from a unique blend of rigorous mathematical content and a remarkably clear and accessible writing style – a rare feat in the often-dense world of algebraic topology. Hatcher skillfully balances abstract concepts with concrete examples, guiding the reader through intricate ideas with exceptional clarity.

II. Structure and Content Breakdown:

Hatcher's book isn't structured in a strictly linear fashion like some textbooks. Instead, it's more modular, allowing for flexibility in the order of study. This can be both a strength and a weakness. While it grants freedom to explore topics based on individual needs and curriculum, it requires a higher level of self-discipline and a clear learning strategy.

The book generally covers the following key areas:

Fundamental Group and Covering Spaces: This foundational section introduces the fundamental group, a crucial invariant in topology, along with the concept of covering spaces – structures that reveal much about the underlying topological space. Hatcher masterfully builds intuition through numerous examples and insightful geometric interpretations.

Homology: This forms the heart of the book, introducing singular homology, a powerful algebraic tool for classifying topological spaces. Hatcher's explanation of homology groups, their properties, and their computation is remarkably clear, gradually escalating in complexity.

Homotopy Theory: Here, Hatcher explores the relationship between continuous maps and their homotopy classes, leading to concepts like homotopy groups and the fundamental group's role in higher-dimensional generalizations.

Cohomology: Building on the foundations of homology, Hatcher introduces cohomology, a dual concept with powerful applications, particularly in algebraic geometry and differential geometry.

Applications: While not explicitly a separate section, applications of algebraic topology weave throughout the text, illustrating the power and relevance of the concepts discussed.

III. Strengths of Hatcher's Approach:

Clarity and Accessibility: Hatcher's writing style stands out for its clarity. He avoids unnecessary jargon and provides intuitive explanations, even for complex ideas.

Intuitive Geometric Approach: The book emphasizes the geometric intuition behind abstract algebraic concepts, making it easier for readers to visualize and understand the material.

Extensive Examples and Exercises: A wealth of examples and exercises solidifies understanding and provides ample opportunities to practice the concepts.

Free Online Availability: The book's availability online makes it accessible to a wider audience, a significant benefit for students and researchers alike.

IV. Potential Challenges:

Non-Linear Structure: The modular structure, while flexible, can require careful planning and self-discipline to follow a logical learning path.

Prerequisites: A strong background in point-set topology and abstract algebra is essential for effectively engaging with the material.

Rigorous Nature: The book is mathematically rigorous, demanding careful attention and a willingness to grapple with abstract concepts.

V. Effective Use of Hatcher's "Algebraic Topology"

Develop a Study Plan: Create a structured learning path, selecting topics based on your curriculum or learning goals.

Supplement with Other Resources: Utilize additional textbooks, online courses, and lecture notes to broaden your understanding and gain different perspectives.

Work Through the Exercises: The exercises are crucial for mastering the concepts. Don't hesitate to seek help or collaborate with others when needed.

Focus on Understanding, Not Memorization: Algebraic topology requires a deep understanding of the underlying concepts, not just rote memorization of formulas.

VI. Detailed Outline of Allen Hatcher's "Algebraic Topology"

Title: Algebraic Topology

Outline:

Introduction: Brief overview of topology, motivations, and a roadmap for the book.
Chapter 0: Basic Topology: Sets, maps, topological spaces, connectedness, compactness, etc.
Chapter 1: Fundamental Group: Definition, computations, covering spaces, group actions, etc.
Chapter 2: Homology: Simplicial homology, singular homology, Mayer-Vietoris sequence, etc.
Chapter 3: Homology with Coefficients: Extension to general coefficients, applications to topology.
Chapter 4: Cellular Homology: Computation using cell structures, applications to CW complexes.
Chapter 5: Cohomology: Definition, cup product, cohomology rings, duality theorems.
Chapter 6: Homotopy Theory: Homotopy groups, fibrations, covering spaces, etc.
Chapter 7: General Topology: Advanced topics, such as more rigorous treatments of spaces and maps.
Appendix: Background material, additional notes, and references.

(Detailed explanation of each chapter would be excessively long for this response, but each point above could be expanded upon in a separate blog post.)

VII. FAQs

1. Is Hatcher's book suitable for undergraduates? Yes, but a strong foundation in algebra and point-set topology is crucial. It might be more suitable for advanced undergraduates or as a supplementary text.

1. What are the prerequisites for reading Hatcher's book? A solid understanding of point-set topology and abstract algebra is essential.

1. Is the book self-taught friendly? While possible, it requires significant self-discipline and the willingness to consult other resources.

1. Are there any alternative textbooks to Hatcher's? Yes, many excellent algebraic

topology texts exist, each with its own strengths and weaknesses.

1. Where can I find solutions to Hatcher's exercises? Solutions are not readily available; working through them independently is highly beneficial.

1. Is the online version identical to the print version? Yes, the online version is complete and identical to the print edition.

1. What is the best way to learn from Hatcher's book? Develop a study plan, supplement with other resources, and diligently work through the exercises.

1. Is Hatcher's book considered a classic? Yes, it's widely regarded as a classic text in the field, praised for its clarity and comprehensive coverage.

1. How long does it take to learn algebraic topology from Hatcher's book? This varies greatly depending on your mathematical background, dedication, and learning style. It could range from several months to several years.

VIII. Related Articles:

1. Introduction to Point-Set Topology: Covers the fundamental concepts of topological spaces, crucial for understanding Hatcher's work.

1. Abstract Algebra for Topologists: Focuses on group theory, ring theory, and module theory relevant to algebraic topology.

1. Understanding Fundamental Groups: A detailed explanation of the fundamental group and its properties.

1. Singular Homology: A Gentle Introduction: A step-by-step guide to understanding singular homology.

1. Homology and Cohomology: A Comparative Study: Explores the relationship between these dual concepts.

1. Applications of Algebraic Topology in Physics: Discusses how algebraic topology is utilized in various areas of physics.

1. Covering Spaces and Their Applications: A deep dive into covering spaces and their importance in algebraic topology.

1. The Mayer-Vietoris Sequence and Its Applications: Explores this powerful tool used in homology calculations.

1. Homotopy Theory and its Connection to Topology: Explores the interplay between homotopy and topology.

allen hatcher algebraic topology: Algebraic Topology Allen Hatcher, 2002 An introductory textbook suitable for use in a course or for self-study, featuring broad coverage of the subject and a readable exposition, with many examples and exercises.

allen hatcher algebraic topology: Introduction to Topological Manifolds John M. Lee, 2006-04-06 Manifolds play an important role in topology, geometry, complex analysis, algebra, and classical mechanics. Learning manifolds differs from most other introductory mathematics in that the subject matter is often completely unfamiliar. This introduction guides readers by explaining the roles manifolds play in diverse branches of mathematics and physics. The book begins with the basics of general topology and gently moves to manifolds, the fundamental group, and covering spaces.

allen hatcher algebraic topology: A Basic Course in Algebraic Topology William S. Massey, 2019-06-28 This textbook is intended for a course in algebraic topology at the beginning graduate level. The main topics covered are the classification of compact 2-manifolds, the fundamental group, covering spaces, singular homology theory, and singular cohomology theory. These topics are developed systematically, avoiding all unnecessary definitions, terminology, and technical machinery. The text consists of material from the first five chapters of the author's earlier book, Algebraic Topology; an Introduction (GTM 56) together with almost all of his book, Singular Homology Theory (GTM 70). The material from the two earlier books has been substantially revised, corrected, and brought up to date.

allen hatcher algebraic topology: *Introduction to Knot Theory* R. H. Crowell, R. H. Fox, 2012-12-06 Knot theory is a kind of geometry, and one whose appeal is very direct because the objects studied are perceivable and tangible in everyday physical space. It is a meeting ground of such diverse branches of mathematics as group theory, matrix theory, number theory, algebraic geometry, and differential geometry, to name some of the more prominent ones. It had its origins in the mathematical theory of electricity and in primitive atomic physics, and there are hints today of new applications in certain branches of chemistryJ The outlines of the modern topological theory were worked out by Dehn, Alexander, Reidemeister, and Seifert almost thirty years ago. As a subfield of topology, knot theory forms the core of a wide range of problems dealing with the position of one manifold imbedded within another. This book, which is an elaboration of a series of lectures given by Fox at Haverford College while a Philips Visitor there in the spring of 1956, is an attempt to make the subject accessible to everyone. Primarily it is a text book for a course at the junior-senior level, but we believe that it can be used with profit also by graduate students. Because the algebra required is not the familiar commutative algebra, a disproportionate amount of the book is given over to necessary algebraic preliminaries.

allen hatcher algebraic topology: Algebraic Topology Edwin H. Spanier, 2012-12-06 This book surveys the fundamental ideas of algebraic topology. The first part covers the fundamental group, its definition and application in the study of covering spaces. The second part turns to homology theory including cohomology, cup products, cohomology operations and topological manifolds. The final part is devoted to Homotropy theory, including basic facts about homotropy groups and applications to obstruction theory.

allen hatcher algebraic topology: Homology Theory James W. Vick, 2012-12-06 This introduction to some basic ideas in algebraic topology is devoted to the foundations and applications of homology theory. After the essentials of singular homology and some important applications are given, successive topics covered include attaching spaces, finite CW complexes, cohomology products, manifolds, Poincare duality, and fixed point theory. This second edition includes a chapter on covering spaces and many new exercises.

allen hatcher algebraic topology: Algebraic Topology: An Intuitive Approach Hajime Satō, 1999 The single most difficult thing one faces when one begins to learn a new branch of mathematics is to get a feel for the mathematical sense of the subject. The purpose of this book is to help the aspiring reader acquire this essential common sense about algebraic topology in a short period of time. To this end, Sato leads the reader through simple but meaningful examples in concrete terms. Moreover, results are not discussed in their greatest possible generality, but in terms of the simplest and most essential cases. In response to suggestions from readers of the original edition of this book, Sato has added an appendix of useful definitions and results on sets, general topology, groups and such. He has also provided references. Topics covered include fundamental notions such as homeomorphisms, homotopy equivalence, fundamental groups and higher homotopy groups, homology and cohomology, fiber bundles, spectral sequences and characteristic classes. Objects and examples considered in the text include the torus, the Möbius strip, the Klein bottle, closed surfaces, cell complexes and vector bundles.

allen hatcher algebraic topology: Algebraic Topology Tammo tom Dieck, 2008 This book is written as a textbook on algebraic topology. The first part covers the material for two introductory courses about homotopy and homology. The second part presents more advanced applications and concepts (duality, characteristic classes, homotopy groups of spheres, bordism). The author recommends starting an introductory course with homotopy theory. For this purpose, classical results are presented with new elementary proofs. Alternatively, one could start more traditionally with singular and axiomatic homology. Additional chapters are devoted to the geometry of manifolds, cell complexes and fibre bundles. A special feature is the rich supply of nearly 500 exercises and problems. Several sections include topics which have not appeared before in textbooks as well as simplified proofs for some important results. Prerequisites are standard point set topology (as recalled in the first chapter), elementary algebraic notions (modules, tensor product), and some terminology from category theory. The aim of the book is to introduce advanced undergraduate and graduate (master's) students to basic tools, concepts and results of algebraic topology. Sufficient background material from geometry and algebra is included.

allen hatcher algebraic topology: More Concise Algebraic Topology J. P. May, K. Ponto, 2012-02 With firm foundations dating only from the 1950s, algebraic topology is a relatively young area of mathematics. There are very few textbooks that treat fundamental topics beyond a first course, and many topics now essential to the field are not treated in any textbook. J. Peter May’s A Concise Course in Algebraic Topology addresses the standard first course material, such as fundamental groups, covering spaces, the basics of homotopy theory, and homology and cohomology. In this sequel, May and his coauthor, Kathleen Ponto, cover topics that are essential for algebraic topologists and others interested in algebraic topology, but that are not treated in standard texts. They focus on the localization and completion of topological spaces, model categories, and Hopf algebras. The first half of the book sets out the basic theory of localization and completion of nilpotent spaces, using the most elementary treatment the authors know of. It makes no use of simplicial techniques or model categories, and it provides full details of other necessary preliminaries. With these topics as motivation, most of the second half of the book sets out the theory of model categories, which is the central organizing framework for homotopical algebra in general. Examples from topology and homological algebra are treated in parallel. A short last part develops the basic theory of bialgebras and Hopf algebras.

allen hatcher algebraic topology: Topology and Geometry Glen E. Bredon, 1993-06-24 This book offers an introductory course in algebraic topology. Starting with general topology, it discusses differentiable manifolds, cohomology, products and duality, the fundamental group, homology theory, and homotopy theory. From the reviews: An interesting and original graduate text in topology and geometry...a good lecturer can use this text to create a fine course....A beginning graduate student can use this text to learn a great deal of mathematics.—-MATHEMATICAL REVIEWS

allen hatcher algebraic topology: Characteristic Classes John Willard Milnor, James D. Stasheff, 1974 The theory of characteristic classes provides a meeting ground for the various disciplines of differential topology, differential and algebraic geometry, cohomology, and fiber bundle theory. As such, it is a fundamental and an essential tool in the study of differentiable manifolds. In this volume, the authors provide a thorough introduction to characteristic classes, with detailed studies of Stiefel-Whitney classes, Chern classes, Pontrjagin classes, and the Euler class. Three appendices cover the basics of cohomology theory and the differential forms approach to characteristic classes, and provide an account of Bernoulli numbers. Based on lecture notes of John Milnor, which first appeared at Princeton University in 1957 and have been widely studied by graduate students of topology ever since, this published version has been completely revised and corrected.

allen hatcher algebraic topology: Elementary Applied Topology Robert W. Ghrist, 2014 This book gives an introduction to the mathematics and applications comprising the new field of applied topology. The elements of this subject are surveyed in the context of applications drawn from the biological, economic, engineering, physical, and statistical sciences.

allen hatcher algebraic topology: Algebra: Chapter 0 Paolo Aluffi, 2021-11-09 Algebra: Chapter 0 is a self-contained introduction to the main topics of algebra, suitable for a first sequence on the subject at the beginning graduate or upper undergraduate level. The primary distinguishing feature of the book, compared to standard textbooks in algebra, is the early introduction of categories, used as a unifying theme in the presentation of the main topics. A second feature consists of an emphasis on homological algebra: basic notions on complexes are presented as soon as modules have been introduced, and an extensive last chapter on homological algebra can form the basis for a follow-up introductory course on the subject. Approximately 1,000 exercises both provide adequate practice to consolidate the understanding of the main body of the text and offer the opportunity to explore many other topics, including applications to number theory and algebraic geometry. This will allow instructors to adapt the textbook to their specific choice of topics and provide the independent reader with a richer exposure to algebra. Many exercises include substantial hints, and navigation of the topics is facilitated by an extensive index and by hundreds of cross-references.

allen hatcher algebraic topology: An Introduction to Differentiable Manifolds and Riemannian Geometry , 1975-08-22 An Introduction to Differentiable Manifolds and Riemannian Geometry

allen hatcher algebraic topology: Categorical Homotopy Theory Emily Riehl, 2014-05-26 This book develops abstract homotopy theory from the categorical perspective with a particular focus on examples. Part I discusses two competing perspectives by which one typically first encounters homotopy (co)limits: either as derived functors definable when the appropriate diagram categories admit a compatible model structure, or through particular formulae that give the right notion in certain examples. Emily Riehl unifies these seemingly rival perspectives and demonstrates that model structures on diagram categories are irrelevant. Homotopy (co)limits are explained to be a special case of weighted (co)limits, a foundational topic in enriched category theory. In Part II, Riehl further examines this topic, separating categorical arguments from homotopical ones. Part III treats the most ubiquitous axiomatic framework for homotopy theory - Quillen's model categories. Here, Riehl simplifies familiar model categorical lemmas and definitions by focusing on weak factorization systems. Part IV introduces quasi-categories and homotopy coherence.

allen hatcher algebraic topology: Complex Cobordism and Stable Homotopy Groups of Spheres Douglas C. Ravenel, 2003-11-25 Since the publication of its first edition, this book has served as one of the few available on the classical Adams spectral sequence, and is the best account on the Adams-Novikov spectral sequence. This new edition has been updated in many places, especially the final chapter, which has been completely rewritten with an eye toward future research in the field. It remains the definitive reference on the stable homotopy groups of spheres. The first three chapters introduce the homotopy groups of spheres and take the reader from the classical results in the field though the computational aspects of the classical Adams spectral sequence and its modifications, which are the main tools topologists have to investigate the homotopy groups of spheres. Nowadays, the most efficient tools are the Brown-Peterson theory, the Adams-Novikov spectral sequence, and the chromatic spectral sequence, a device for analyzing the global structure of the stable homotopy groups of spheres and relating them to the cohomology of the Morava stabilizer groups. These topics are described in detail in Chapters 4 to 6. The revamped Chapter 7 is the computational payoff of the book, yielding a lot of information about the stable homotopy group of spheres. Appendices follow, giving self-contained accounts of the theory of formal group laws and the homological algebra associated with Hopf algebras and Hopf algebroids. The book is intended for anyone wishing to study computational stable homotopy theory. It is accessible to graduate students with a knowledge of algebraic topology and recommended to anyone wishing to venture into the frontiers of the subject.

allen hatcher algebraic topology: *Foundations of Algebraic Topology* Samuel Eilenberg, Norman Steenrod, 2015-12-08 The need for an axiomatic treatment of homology and cohomology theory has long been felt by topologists. Professors Eilenberg and Steenrod present here for the first time an axiomatization of the complete transition from topology to algebra. Originally published in 1952. The Princeton Legacy Library uses the latest print-on-demand technology to again make available previously out-of-print books from the distinguished backlist of Princeton University Press. These editions preserve the original texts of these important books while presenting them in durable paperback and hardcover editions. The goal of the Princeton Legacy Library is to vastly increase access to the rich scholarly heritage found in the thousands of books published by Princeton University Press since its founding in 1905.

allen hatcher algebraic topology: Bordism, Stable Homotopy and Adams Spectral Sequences Stanley O. Kochman, 1996 This book is a compilation of lecture notes that were prepared for the graduate course ``Adams Spectral Sequences and Stable Homotopy Theory'' given at The Fields Institute during the fall of 1995. The aim of this volume is to prepare students with a knowledge of elementary algebraic topology to study recent developments in stable homotopy theory, such as the nilpotence and periodicity theorems. Suitable as a text for an intermediate course in algebraic topology, this book provides a direct exposition of the basic concepts of bordism, characteristic classes, Adams spectral sequences, Brown-Peterson spectra and the computation of stable stems. The key ideas are presented in complete detail without becoming encyclopedic. The approach to characteristic classes and some of the methods for computing stable stems have not been published previously. All results are proved in complete detail. Only elementary facts from algebraic topology and homological algebra are assumed. Each chapter concludes with a guide for further study.

allen hatcher algebraic topology: A Concise Course in Algebraic Topology J. P. May, 1999-09 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.

allen hatcher algebraic topology: Algebraic Topology William Fulton, 2013-12-01 To the Teacher. This book is designed to introduce a student to some of the important ideas of algebraic topology by emphasizing the re lations of these ideas with other areas of mathematics. Rather than choosing one point of view of modem topology (homotopy theory, simplicial complexes, singular theory, axiomatic homology, differ ential topology, etc.), we concentrate our attention on concrete prob lems in low dimensions, introducing only as much algebraic machin ery as necessary for the problems we meet. This makes it possible to see a wider variety of important features of the subject than is usual in a beginning text. The book is designed for students of mathematics or science who are not aiming to become practicing algebraic topol ogists-without, we hope, discouraging budding topologists. We also feel that this approach is in better harmony with the historical devel opment of the subject. What would we like a student to know after a first course in to pology (assuming we reject the answer: half of what one would like the student to know after a second course in topology)? Our answers to this have guided the choice of material, which includes: under standing the relation between homology and integration, first on plane domains, later on Riemann surfaces and in higher dimensions; wind ing numbers and degrees of mappings, fixed-point theorems; appli cations such as the Jordan curve theorem, invariance of domain; in dices of vector fields and Euler characteristics; fundamental groups

allen hatcher algebraic topology: Algebraic Topology - Homotopy and Homology Robert M. Switzer, 2017-12-01 From the reviews: The author has attempted an ambitious and most commendable project. [...] The book contains much material that has not previously appeared in this format. The writing is clean and clear and the exposition is well motivated. [...] This book is, all in all, a very admirable work and a valuable addition to the literature. Mathematical Reviews

allen hatcher algebraic topology: Classical Topology and Combinatorial Group Theory John Stillwell, 2012-12-06 In recent years, many students have been introduced to topology in high school mathematics. Having met the Mobius band, the seven bridges of Konigsberg, Euler's polyhedron formula, and knots, the student is led to expect that these picturesque ideas will come to full flower in university topology courses. What a disappointment undergraduate topology proves to be! In most institutions it is either a service course for analysts, on abstract spaces, or else an introduction to homological algebra in which the only geometric activity is the completion of commutative diagrams. Pictures are kept to a minimum, and at the end the student still does nr~ understand the simplest topological facts, such as the rcason why knots exist. In my opinion, a well-balanced introduction to topology should stress its intuitive geometric aspect, while admitting the legitimate interest that analysts and algebraists have in the subject. At any rate, this is the aim of the present book. In support of this view, I have followed the historical development where practicable, since it clearly shows the influence of geometric thought at all stages. This is not to claim that topology received its main impetus from geometric recreations like the seven bridges; rather, it resulted from the l'isualization of problems from other parts of mathematics-complex analysis (Riemann), mechanics (Poincare), and group theory (Dehn). It is these connec tions to other parts of mathematics which make topology an important as well as a beautiful subject.

allen hatcher algebraic topology: Basic Category Theory Tom Leinster, 2014-07-24 A short introduction ideal for students learning category theory for the first time.

allen hatcher algebraic topology: Categories and Functors Bodo Pareigis, 1970

allen hatcher algebraic topology: Topology Tai-Danae Bradley, Tyler Bryson, John Terilla, 2020-08-18 A graduate-level textbook that presents basic topology from the perspective of category theory. This graduate-level textbook on topology takes a unique approach: it reintroduces basic, point-set topology from a more modern, categorical perspective. Many graduate students are familiar with the ideas of point-set topology and they are ready to learn something new about them. Teaching the subject using category theory--a contemporary branch of mathematics that provides a way to represent abstract concepts--both deepens students' understanding of elementary topology and lays a solid foundation for future work in advanced topics.

allen hatcher algebraic topology: Basic Concepts of Algebraic Topology F.H. Croom, 2012-12-06 This text is intended as a one semester introduction to algebraic topology at the undergraduate and beginning graduate levels. Basically, it covers simplicial homology theory, the fundamental group, covering spaces, the higher homotopy groups and introductory singular homology theory. The text follows a broad historical outline and uses the proofs of the discoverers of the important theorems when this is consistent with the elementary level of the course. This method of presentation is intended to reduce the abstract nature of algebraic topology to a level that is palatable for the beginning student and to provide motivation and cohesion that are often lacking in abstact treatments. The text emphasizes the geometric approach to algebraic topology and attempts to show the importance of topological concepts by applying them to problems of geometry and analysis. The prerequisites for this course are calculus at the sophomore level, a one semester introduction to the theory of groups, a one semester introduc tion to point-set topology and some familiarity with vector spaces. Outlines of the prerequisite material can be found in the appendices at the end of the text. It is suggested that the reader not spend time initially working on the appendices, but rather that he read from the beginning of the text, referring to the appendices as his memory needs refreshing. The text is designed for use by college juniors of normal intelligence and does not require mathematical maturity beyond the junior level.

allen hatcher algebraic topology: Topology Through Inquiry Michael Starbird, Francis Su, 2020-09-10 Topology Through Inquiry is a comprehensive introduction to point-set, algebraic, and geometric topology, designed to support inquiry-based learning (IBL) courses for upper-division undergraduate or beginning graduate students. The book presents an enormous amount of topology, allowing an instructor to choose which topics to treat. The point-set material contains many interesting topics well beyond the basic core, including continua and metrizability. Geometric and algebraic topology topics include the classification of 2-manifolds, the fundamental group, covering spaces, and homology (simplicial and singular). A unique feature of the introduction to homology is to convey a clear geometric motivation by starting with mod 2 coefficients. The authors are acknowledged masters of IBL-style teaching. This book gives students joy-filled, manageable challenges that incrementally develop their knowledge and skills. The exposition includes insightful framing of fruitful points of view as well as advice on effective thinking and learning. The text presumes only a modest level of mathematical maturity to begin, but students who work their way through this text will grow from mathematics students into mathematicians. Michael Starbird is a University of Texas Distinguished Teaching Professor of Mathematics. Among his works are two other co-authored books in the Mathematical Association of America's (MAA) Textbook series. Francis Su is the Benediktsson-Karwa Professor of Mathematics at Harvey Mudd College and a past president of the MAA. Both authors are award-winning teachers, including each having received the MAA's Haimo Award for distinguished teaching. Starbird and Su are, jointly and individually, on lifelong missions to make learning—of mathematics and beyond—joyful, effective, and available to everyone. This book invites topology students and teachers to join in the adventure.

allen hatcher algebraic topology: Undergraduate Algebraic Geometry Miles Reid, Miles A. Reid, 1988-12-15 Algebraic geometry is, essentially, the study of the solution of equations and occupies a central position in pure mathematics. This short and readable introduction to algebraic geometry will be ideal for all undergraduate mathematicians coming to the subject for the first time. With the minimum of prerequisites, Dr Reid introduces the reader to the basic concepts of algebraic geometry including: plane conics, cubics and the group law, affine and projective varieties, and non-singularity and dimension. He is at pains to stress the connections the subject has with commutative algebra as well as its relation to topology, differential geometry, and number theory. The book arises from an undergraduate course given at the University of Warwick and contains numerous examples and exercises illustrating the theory.

allen hatcher algebraic topology: An Illustrated Theory of Numbers Martin H. Weissman, 2020-09-15 News about this title: — Author Marty Weissman has been awarded a Guggenheim Fellowship for 2020. (Learn more here.) — Selected as a 2018 CHOICE Outstanding Academic Title — 2018 PROSE Awards Honorable Mention An Illustrated Theory of Numbers gives a comprehensive introduction to number theory, with complete proofs, worked examples, and exercises. Its exposition reflects the most recent scholarship in mathematics and its history. Almost 500 sharp illustrations accompany elegant proofs, from prime decomposition through quadratic reciprocity. Geometric and dynamical arguments provide new insights, and allow for a rigorous approach with less algebraic manipulation. The final chapters contain an extended treatment of binary quadratic forms, using Conway's topograph to solve quadratic Diophantine equations (e.g., Pell's equation) and to study reduction and the finiteness of class numbers. Data visualizations introduce the reader to open questions and cutting-edge results in analytic number theory such as the Riemann hypothesis, boundedness of prime gaps, and the class number 1 problem. Accompanying each chapter, historical notes curate primary sources and secondary scholarship to trace the development of number theory within and outside the Western tradition. Requiring only high school algebra and geometry, this text is recommended for a first course in elementary number theory. It is also suitable for mathematicians seeking a fresh perspective on an ancient subject.

allen hatcher algebraic topology: Algebraic Topology Marvin J. Greenberg, 2018-03-05 Great first book on algebraic topology. Introduces (co)homology through singular theory.

allen hatcher algebraic topology: Introduction to Smooth Manifolds John M. Lee, 2013-03-09 Author has written several excellent Springer books.; This book is a sequel to Introduction to Topological Manifolds; Careful and illuminating explanations, excellent diagrams and exemplary motivation; Includes short preliminary sections before each section explaining what is ahead and why

allen hatcher algebraic topology: A Topological Introduction to Nonlinear Analysis Robert F. Brown, 2014-11-27 This third edition is addressed to the mathematician or graduate student of mathematics - or even the well-prepared undergraduate - who would like, with a minimum of background and preparation, to understand some of the beautiful results at the heart of nonlinear analysis. Based on carefully-expounded ideas from several branches of topology, and illustrated by a wealth of figures that attest to the geometric nature of the exposition, the book will be of immense help in providing its readers with an understanding of the mathematics of the nonlinear phenomena that characterize our real world. Included in this new edition are several new chapters that present the fixed point index and its applications. The exposition and mathematical content is improved throughout. This book is ideal for self-study for mathematicians and students interested in such areas of geometric and algebraic topology, functional analysis, differential equations, and applied mathematics. It is a sharply focused and highly readable view of nonlinear analysis by a practicing topologist who has seen a clear path to understanding. For the topology-minded reader, the book indeed has a lot to offer: written in a very personal, eloquent and instructive style it makes one of the highlights of nonlinear analysis accessible to a wide audience.-Monatshefte fur Mathematik (2006)

allen hatcher algebraic topology: *Using the Borsuk-Ulam Theorem* Jiri Matousek, 2008-01-12 To the uninitiated, algebraic topology might seem fiendishly complex, but its utility is beyond doubt. This brilliant exposition goes back to basics to explain how the subject has been used to further our understanding in some key areas. A number of important results in combinatorics, discrete geometry, and theoretical computer science have been proved using algebraic topology. While the results are quite famous, their proofs are not so widely understood. This book is the first textbook treatment of a significant part of these results. It focuses on so-called equivariant methods, based on the Borsuk-Ulam theorem and its generalizations. The topological tools are intentionally kept on a very elementary level. No prior knowledge of algebraic topology is assumed, only a background in undergraduate mathematics, and the required topological notions and results are gradually explained.

allen hatcher algebraic topology: Algebraic L-theory and Topological Manifolds Andrew Ranicki, 1992-12-10 Assuming no previous acquaintance with surgery theory and justifying all the algebraic concepts used by their relevance to topology, Dr Ranicki explains the applications of quadratic forms to the classification of topological manifolds, in a unified algebraic framework.

allen hatcher algebraic topology: *Elementary Concepts of Topology* Paul Alexandroff, 2012-08-13 Concise work presents topological concepts in clear, elementary fashion, from basics of set-theoretic topology, through topological theorems and questions based on concept of the algebraic complex, to the concept of Betti groups. Includes 25 figures.

allen hatcher algebraic topology: Algebraic Topology Satya Deo, 2003-12-01

allen hatcher algebraic topology: K-Theory Max Karoubi, 2009-11-27 From the Preface: K-theory was introduced by A. Grothendieck in his formulation of the Riemann- Roch theorem. For each projective algebraic variety, Grothendieck constructed a group from the category of coherent algebraic sheaves, and showed that it had many nice properties. Atiyah and Hirzebruch considered a topological analog defined for any compact space X, a group K{X) constructed from the category of vector bundles on X. It is this ''topological K-theory that this book will study. Topological K-theory has become an important tool in topology. Using K- theory, Adams and Atiyah were able to give a simple proof that the only spheres which can be provided with H-space structures are S1, S3 and S7. Moreover, it is possible to derive a substantial part of stable homotopy theory from K-theory. The purpose of this book is to provide advanced students and mathematicians in other fields with the fundamental material in this subject. In addition, several applications of the type described above are included. In general we have tried to make this book self-contained, beginning with elementary concepts wherever possible; however, we assume that the reader is familiar with the basic definitions of homotopy theory: homotopy classes of maps and homotopy groups.Thus this book might be regarded as a fairly self-contained introduction to a generalized cohomology theory.

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Marcelo Aguiar, Swapneel Arvind Mahajan, 2010 This research monograph integrates ideas from category theory, algebra and combinatorics. It is organized in three parts. Part I belongs to the realm of category theory. It reviews some of the foundational work of Benabou, Eilenberg, Kelly and Mac Lane on monoidal categories and of Joyal and Street on braided monoidal categories, and proceeds to study higher monoidal categories and higher monoidal functors. Special attention is devoted to the notion of a bilax monoidal functor which plays a central role in this work. Combinatorics and geometry are the theme of Part II. Joyal's species constitute a good framework for the study of algebraic structures associated to combinatorial objects. This part discusses the category of species focusing particularly on the Hopf monoids therein. The notion of a Hopf monoid in species parallels that of a Hopf algebra and reflects the manner in which combinatorial structures compose and decompose. Numerous examples of Hopf monoids are given in the text. These are constructed from combinatorial and geometric data and inspired by ideas of Rota and Tits' theory of Coxeter complexes. Part III is of an algebraic nature and shows how ideas in Parts I and II lead to a unified approach to Hopf algebras. The main step is the construction of Fock functors from species to graded vector spaces. These functors are bilax monoidal and thus translate Hopf monoids in species to graded Hopf algebras. This functorial construction of Hopf algebras encompasses both quantum groups and the Hopf algebras of recent prominence in the combinatorics literature. The monograph opens a vast new area of research. It is written with clarity and sufficient detail to make it accessible to advanced graduate students.

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