

# *A First Course in Information Theory*

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Raymond W. Yeung

# First Course In Information Theory

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## **First Course In Information Theory:**

**A First Course in Information Theory** Raymond W. Yeung, 2002-04-30 An introduction to information theory for discrete random variables Classical topics and fundamental tools are presented along with three selected advanced topics Yeung Chinese U of Hong Kong presents chapters on information measures zero error data compression weak and strong typicality the I measure Markov structures channel capacity rate distortion theory Blahut Arimoto algorithms information inequalities and Shannon type inequalities The advanced topics included are single source network coding multi source network coding and entropy and groups Annotation copyrighted by Book News Inc Portland OR *A First Course in Information Theory* Springer, 2012-11-01 *A First Course in Information Theory* Raymond W. Yeung, 2012-12-06 A First Course in Information Theory is an up to date introduction to information theory In addition to the classical topics discussed it provides the first comprehensive treatment of the theory of I Measure network coding theory Shannon and non Shannon type information inequalities and a relation between entropy and group theory ITIP a software package for proving information inequalities is also included With a large number of examples illustrations and original problems this book is excellent as a textbook or reference book for a senior or graduate level course on the subject as well as a reference for researchers in related fields *A First Course in Coding Theory* Raymond Hill, 1986 Algebraic coding theory is a new and rapidly developing subject popular for its many practical applications and for its fascinatingly rich mathematical structure This book provides an elementary yet rigorous introduction to the theory of error correcting codes Based on courses given by the author over several years to advanced undergraduates and first year graduated students this guide includes a large number of exercises all with solutions making the book highly suitable for individual study *Information Theory and Network Coding* Raymond W. Yeung, 2008-09-10 This book is an evolution from my book *A First Course in Information Theory* published in 2002 when network coding was still at its infancy The last few years have witnessed the rapid development of network coding into a research eld of its own in information science With its root in infor tion theory network coding has not only brought about a paradigm shift in network communications at large but also had signi cant in uence on such speci c research elds as coding theory networking switching wireless c munications distributeddatastorage cryptography and optimization theory While new applications of network coding keep emerging the fundamental sults that lay the foundation of the subject are more or less mature One of the main goals of this book therefore is to present these results in a unifying and coherent manner While the previous book focused only on information theory for discrete random variables the current book contains two new chapters on information theory for continuous random variables namely the chapter on differential entropy and the chapter on continuous valued channels With these topics included the book becomes more comprehensive and is more suitable to be used as a textbook for a course in an electrical engineering department

**Coding and Information Theory** Steven Roman, 1992-06-04 This book is an introduction to information and coding

theory at the graduate or advanced undergraduate level It assumes a basic knowledge of probability and modern algebra but is otherwise self contained The intent is to describe as clearly as possible the fundamental issues involved in these subjects rather than covering all aspects in an encyclopedic fashion The first quarter of the book is devoted to information theory including a proof of Shannon's famous Noisy Coding Theorem The remainder of the book is devoted to coding theory and is independent of the information theory portion of the book After a brief discussion of general families of codes the author discusses linear codes including the Hamming Golay the Reed Muller codes finite fields and cyclic codes including the BCH Reed Solomon Justesen Goppa and Quadratic Residue codes An appendix reviews relevant topics from modern algebra

*Six Quantum Pieces: A First Course In Quantum Physics* Valerio Scarani, Lynn Chua, Shi Yang Liu, 2010-09-16 This book is an original first approach to quantum physics the core of modern physics It combines the competence of a well known researcher in quantum information science and the freshness in style of two high school students Quantum physics is known to be challenging for two reasons it describes counter intuitive phenomena and employs rather advanced mathematics The description of traditional quantum phenomena the structure of atoms and molecules the properties of solids the zoology of sub atomic particles does indeed involve the whole formalism However some other striking phenomena somehow the most typically quantum ones can be described using only high school mathematical skills This approach exploits this fact thus making it possible for a beginner to tackle mind boggling experiments like teleportation and the violation of Bell's inequalities and practice notions like superposition entanglement and decoherence

**Mathematical Principles of the Internet, Volume 1** Nirdosh Bhatnagar, 2018-11-20 This two volume set on Mathematical Principles of the Internet provides a comprehensive overview of the mathematical principles of Internet engineering The books do not aim to provide all of the mathematical foundations upon which the Internet is based Instead they cover a partial panorama and the key principles Volume 1 explores Internet engineering while the supporting mathematics is covered in Volume 2 The chapters on mathematics complement those on the engineering episodes and an effort has been made to make this work succinct yet self contained Elements of information theory algebraic coding theory cryptography Internet traffic dynamics and control of Internet congestion and queueing theory are discussed In addition stochastic networks graph theoretic algorithms application of game theory to the Internet Internet economics data mining and knowledge discovery and quantum computation communication and cryptography are also discussed In order to study the structure and function of the Internet only a basic knowledge of number theory abstract algebra matrices and determinants graph theory geometry analysis optimization theory probability theory and stochastic processes is required These mathematical disciplines are defined and developed in the books to the extent that is needed to develop and justify their application to Internet engineering

*Classical Topics in Complex Function Theory* Reinhold Remmert, 2013-03-14 An ideal text for an advanced course in the theory of complex functions this book leads readers to experience function theory personally and to participate in the work of

the creative mathematician The author includes numerous glimpses of the function theory of several complex variables which illustrate how autonomous this discipline has become In addition to standard topics readers will find Eisenstein s proof of Euler s product formula for the sine function Wielandts uniqueness theorem for the gamma function Stirlings formula Isssas theorem Besses proof that all domains in  $\mathbb{C}$  are domains of holomorphy Wedderburns lemma and the ideal theory of rings of holomorphic functions Estermanns proofs of the overconvergence theorem and Blochs theorem a holomorphic imbedding of the unit disc in  $\mathbb{C}^3$  and Gausss expert opinion on Riemanns dissertation Remmert elegantly presents the material in short clear sections with compact proofs and historical comments interwoven throughout the text The abundance of examples exercises and historical remarks as well as the extensive bibliography combine to make an invaluable source for students and teachers alike

**Field and Galois Theory** Patrick Morandi, 2012-12-06 In the fall of 1990 I taught Math 581 at New Mexico State University for the first time This course on field theory is the first semester of the year long graduate algebra course here at NMSU In the back of my mind I thought it would be nice someday to write a book on field theory one of my favorite mathematical subjects and I wrote a crude form of lecture notes that semester Those notes sat undisturbed for three years until late in 1993 when I finally made the decision to turn the notes into a book The notes were greatly expanded and rewritten and they were in a form sufficient to be used as the text for Math 581 when I taught it again in the fall of 1994 Part of my desire to write a textbook was due to the nonstandard format of our graduate algebra sequence The first semester of our sequence is field theory Our graduate students generally pick up group and ring theory in a senior level course prior to taking field theory Since we start with field theory we would have to jump into the middle of most graduate algebra textbooks This can make reading the text difficult by not knowing what the author did before the field theory chapters Therefore a book devoted to field theory is desirable for us as a text While there are a number of field theory books around most of these were less complete than I wanted

**Homology Theory** James W. Vick, 2012-12-06 The 20 years since the publication of this book have been an era of continuing growth and development in the field of algebraic topology New generations of young mathematicians have been trained and classical problems have been solved particularly through the application of geometry and knot theory Diverse new resources for introductory coursework have appeared but there is persistent interest in an intuitive treatment of the basic ideas This second edition has been expanded through the addition of a chapter on covering spaces By analysis of the lifting problem it introduces the fundamental group and explores its properties including Van Kampen s Theorem and the relationship with the first homology group It has been inserted after the third chapter since it uses some definitions and results included prior to that point However much of the material is directly accessible from the same background as Chapter 1 so there would be some flexibility in how these topics are integrated into a course The Bibliography has been supplemented by the addition of selected books and historical articles that have appeared since 1973

Additive Number Theory The Classical Bases Melvyn B. Nathanson, 2013-03-14 Hilbert s style has not the terseness of

many of our modern authors in mathematics which is based on the assumption that printer's labor and paper are costly but the reader's effort and time are not. H. Weyl 143 The purpose of this book is to describe the classical problems in additive number theory and to introduce the circle method and the sieve method which are the basic analytical and combinatorial tools used to attack these problems. This book is intended for students who want to learn additive number theory not for experts who already know it. For this reason proofs include many unnecessary and obvious steps; this is by design. The archetypical theorem in additive number theory is due to Lagrange: Every nonnegative integer is the sum of four squares. In general the set  $A$  of nonnegative integers is called an additive basis of order  $h$  if every nonnegative integer can be written as the sum of  $h$  not necessarily distinct elements of  $A$ . Lagrange's theorem is the statement that the squares are a basis of order four. The set  $A$  is called a basis of infinite order if  $A$  is a basis of order  $h$  for some positive integer  $h$ . Additive number theory is in large part the study of bases of finite order. The classical bases are the squares, cubes, and higher powers, the polygonal numbers, and the prime numbers. The classical questions associated with these bases are Waring's problem and the Goldbach conjecture.

**Algebraic K-Theory and Its Applications** Jonathan Rosenberg, 2012-12-06 Algebraic K-Theory plays an important role in many areas of modern mathematics, most notably algebraic topology, number theory, and algebraic geometry, but even including operator theory. The broad range of these topics has tended to give the subject an aura of inapproachability. This book, based on a course at the University of Maryland in the fall of 1990, is intended to enable graduate students or mathematicians working in other areas not only to learn the basics of algebraic K-Theory but also to get a feel for its many applications. The required prerequisites are only the standard one-year graduate algebra course and the standard introductory graduate course on algebraic and geometric topology. Many topics from algebraic topology, homological algebra, and algebraic number theory are developed as needed. The final chapter gives a concise introduction to cyclic homology and its interrelationship with K-Theory.

**An Introduction to Markov Processes** Daniel W. Stroock, 2005-10-14 To some extent it would be accurate to summarize the contents of this book as an intolerably protracted description of what happens when either one raises a transition probability matrix  $P$  (i.e., all entries  $P_{ij}$  are non-negative and each row of  $P$  sums to 1) to higher and higher powers or one exponentiates  $R^{-1} P I$  where  $R$  is a diagonal matrix with non-negative entries. Indeed, when it comes right down to it, that is all that is done in this book. However, I and others of my ilk would take offense at such a dismissive characterization of the theory of Markov chains and processes with values in a countable state space, and a primary goal of mine in writing this book was to convince its readers that our offense would be warranted. The reason why I and others of my persuasion refuse to consider the theory here as no more than a subset of matrix theory is that to do so is to ignore the pervasive role that probability plays throughout. Namely, probability theory provides a model which both motivates and provides a context for what we are doing with these matrices. To wit, even the term transition probability matrix lends meaning to an otherwise rather peculiar set of hypotheses to make about a matrix.

**Topology and Geometry** Glen E.

Bredon,2013-03-09 The golden age of mathematics that was not the age of Euclid it is ours C J KEYSER This time of writing is the hundredth anniversary of the publication 1892 of Poincare's first note on topology which arguably marks the beginning of the subject of algebraic or combinatorial topology There was earlier scattered work by Euler Listing who coined the word topology Mobius and his band Riemann Klein and Betti Indeed even as early as 1679 Leibniz indicated the desirability of creating a geometry of the topological type The establishment of topology or analysis situs as it was often called at the time as a coherent theory however belongs to Poincare Curiously the beginning of general topology also called point set topology dates fourteen years later when Frechet published the first abstract treatment of the subject in 1906 Since the beginning of time or at least the era of Archimedes smooth manifolds curves surfaces mechanical configurations the universe have been a central focus in mathematics They have always been at the core of interest in topology After the seminal work of Milnor Smale and many others in the last half of this century the topological aspects of smooth manifolds as distinct from the differential geometric aspects became a subject in its own right Using Algebraic Geometry David A Cox,John Little,Donal O'Shea,2005-03-17 The discovery of new algorithms for dealing with polynomial equations and their implementation on fast inexpensive computers has revolutionized algebraic geometry and led to exciting new applications in the field This book details many uses of algebraic geometry and highlights recent applications of Grobner bases and resultants This edition contains two new sections a new chapter updated references and many minor improvements throughout **Combinatorial Commutative Algebra** Ezra Miller,Bernd Sturmfels,2005-06-21 Recent developments are covered Contains over 100 figures and 250 exercises Includes complete proofs **Analysis and Probability** Pallo E. T. Jorgensen,2007-10-17 If people do not believe that mathematics is simple it is only because they do not realize how complicated life is John von Neumann While this is a course in analysis our approach departs from the beaten path in some ways Firstly we emphasize a variety of connections to themes from neighboring fields such as wavelets fractals and signals topics typically not included in a graduate analysis course This in turn entails excursions into domains with a probabilistic flavor Yet the diverse parts of the book follow a common underlying thread and together they constitute a good blend each part in the mix naturally complements the other In fact there are now good reasons for taking a wider view of analysis for example the fact that several applied trends have come to interact in new and exciting ways with traditional mathematical analysis as it was taught in graduate classes for generations One consequence of these impulses from outside is that conventional boundaries between core disciplines in mathematics have become more blurred Fortunately this branching out does not mean that students will need to start out with any different or additional prerequisites In fact the ideas involved in this book are intuitive natural many of them visual and geometric The required background is quite minimal and it does not go beyond what is typically required in most graduate programs **Mathematical Methods of Classical Mechanics** V.I. Arnol'd,2013-04-09 In this text the author constructs the mathematical apparatus of classical mechanics from the beginning examining all the basic problems in

dynamics including the theory of oscillations the theory of rigid body motion and the Hamiltonian formalism This modern approach based on the theory of the geometry of manifolds distinguishes itself from the traditional approach of standard textbooks Geometrical considerations are emphasized throughout and include phase spaces and flows vector fields and Lie groups The work includes a detailed discussion of qualitative methods of the theory of dynamical systems and of asymptotic methods like perturbation techniques averaging and adiabatic invariance Fermat's Last Theorem Harold M.

Edwards, 2000-01-14 This introduction to algebraic number theory via the famous problem of Fermat's Last Theorem follows its historical development beginning with the work of Fermat and ending with Kummer's theory of ideal factorization The more elementary topics such as Euler's proof of the impossibility of  $x^n + y^n = z^n$  are treated in an uncomplicated way and new concepts and techniques are introduced only after having been motivated by specific problems The book also covers in detail the application of Kummer's theory to quadratic integers and relates this to Gauss' theory of binary quadratic forms an interesting and important connection that is not explored in any other book



## Unveiling the Magic of Words: A Review of "**First Course In Information Theory**"

In some sort of defined by information and interconnectivity, the enchanting power of words has acquired unparalleled significance. Their power to kindle emotions, provoke contemplation, and ignite transformative change is truly awe-inspiring. Enter the realm of "**First Course In Information Theory**," a mesmerizing literary masterpiece penned with a distinguished author, guiding readers on a profound journey to unravel the secrets and potential hidden within every word. In this critique, we shall delve to the book is central themes, examine its distinctive writing style, and assess its profound effect on the souls of its readers.

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