Coding Theory Lecture Notes

Nathan Kaplan and speakers of the tutorial

September 7, 2011

These are the notes for the 2011 Summer Tutorial on Coding Theory. I have not gone through and given citations or references for all of the results given here, but the presentation relies heavily on two sources, van Lint's Introduction to Coding Theory and the book of Huffman and Pless, Fundamentals of Error-Correcting Codes. I also used course notes written by Sebastian Pancratz from a Part II course given at Cambridge on Coding Theory and Cryptography given by Professor Tom Fisher, and my own course notes from a Cambridge Part III course on Advanced Coding Techniques given by Professor Ian Grojnowski. I also included notes from Henry Cohn's MIT course, Applied Math for the Pure Mathematician. This last course of the notes is based on Nigel Boston's course called "Graph Based Codes".

All mistakes in these notes are my fault.

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　　High-Dimensional Probability Roman Vershynin,2018-09-27 An integrated package of powerful probabilistic tools and key applications in modern mathematical data science 　　*Recent Developments in the Inverse Galois Problem* Jointsummerresearchconf Onrecentdevel Intheinverse,1995-07-30 This book contains the refereed proceedings of the AMS IMS SIAM Joint Summer Research Conference on Recent Developments in the Inverse Galois Problem held in July 1993 at the University of Washington Seattle A new review of Serre s Topics in Galois Theory serves as a starting point The book describes the latest research on explicit presentation of the absolute Galois group of the rationals Containing the first appearance of generalizations of modular curves the book presents applications that demonstrate the full scope of the Inverse Galois Problem In particular the papers collected here show the ubiquity of the applications of the Inverse Galois Problem and its compelling significance The book will serve as a guide to progress on the Inverse Galois Problem and as an aid in using this work in other areas of mathematics This includes coding theory and other finite field applications Group theory and a first course in algebraic curves are sufficient for understanding many papers in the volume Graduate students will find this an excellent reference to current research as it contains a list of problems appropriate for thesis material in arithmetic geometry algebraic number theory and group theory 　　**Coding Theory And Cryptology** Harald Niederreiter,2002-12-03 The inaugural research program of the Institute for Mathematical Sciences at the National University of Singapore took place from July to December 2001 and was devoted to coding theory and cryptology As part of the program tutorials for graduate students and junior researchers were given by world renowned scholars These tutorials covered fundamental aspects of coding theory and cryptology and were designed to prepare for original research in these areas The present volume collects the expanded lecture notes of these tutorials The topics range from mathematical areas such as computational number theory exponential sums and algebraic function fields through coding theory subjects such as extremal problems quantum error correcting codes and algebraic geometry codes to cryptologic subjects such as stream ciphers public key infrastructures key management authentication schemes and distributed system security 　　**Coding Theory** Kit Tyabandha,2007-01-17 This book was written from the material I prepared for my teaching of a course Coding Theory at the Mathematics Department Mahidol University Thailand in the second term from end 2005 until early 2006 when I used to be a lecturer there 　　Mathematical Reviews ,2003 　　*Information Theoretic Learning* Jose C. Principe,2010-04-06 This book is the first cohesive treatment of ITL algorithms to adapt linear or nonlinear learning machines both in supervised and unsupervised paradigms It compares the performance of ITL algorithms with the second order counterparts in many applications 　　**Computational Optimization** Jong-Shi Pang,2012-12-06 Computational Optimization A Tribute to Olvi Mangasarian serves as an excellent reference providing insight into some of the most challenging research issues in the field This collection of papers covers a wide spectrum of computational optimization topics representing a blend of familiar

nonlinear programming topics and such novel paradigms as semidefinite programming and complementarity constrained nonlinear programs Many new results are presented in these papers which are bound to inspire further research and generate new avenues for applications An informal categorization of the papers includes Algorithmic advances for special classes of constrained optimization problems Analysis of linear and nonlinear programs Algorithmic advances B stationary points of mathematical programs with equilibrium constraints Applications of optimization Some mathematical topics Systems of nonlinear equations   *Coding Theory* J. H. van Lint,1973-01-01 These lecture notes are the contents of a two term course given by me during the 1970 1971 academic year as Morgan Ward visiting professor at the California Institute of Technology The students who took the course were mathematics seniors and graduate students Therefore a thorough knowledge of algebra a o linear algebra theory of finite fields characters of abelian groups and also probability theory were assumed After introducing coding theory and linear codes these notes concern topics mostly from algebraic coding theory The practical side of the subject e g circuitry is not included Some topics which one would like to include 1n a course for students of mathematics such as bounds on the information rate of codes and many connections between combinatorial mathematics and coding theory could not be treated due to lack of time For an extension of the course into a third term these two topics would have been chosen Although the material for this course came from many sources there are three which contributed heavily and which were used as suggested reading material for the students These are W W Peterson s Error Correcting Codes 15 E R Berlekamp s Algebraic Coding Theory 5 and several of the AFCRL reports by E F Assmus H F Mattson and R Turyn 2 3 4 a o For several fruitful discussions I would like to thank R J McEliece   **University of California Union Catalog of Monographs Cataloged by the Nine Campuses from 1963 Through 1967: Authors & titles** University of California (System). Institute of Library Research,University of California, Berkeley,1972   *Introduction To Algebraic Coding Theory* Tzuong-tsieng Moh,2022-02-18 We live in the age of technology where messages are transmitted in sequences of 0 s and 1 s through space It is possible to make an error with noisy channels so self correcting codes become vital to eradicate all errors as the number of errors is small These self correcting codes are widely used in the industry for a variety of applications including e mail telephone remote sensing e g photographs of Mars amongst others We will present some essentials of the theory in this book Using linear algebra we have the salient Hamming codes The next level of coding theory is through the usage of ring theory especially polynomials rational functions and power series to produce BCH codes Reed Solomon codes and the classical Goppa codes Then we progress to the geometric Goppa code using Algebraic Geometry   **Introduction to Coding Theory and Algebraic Geometry** J. van Lint,G. van der Geer,1988-09-01 These notes are based on lectures given in the semmar on Coding Theory and Algebraic Geometry held at Schloss Mickeln Diisseldorf November 16 21 1987 In 1982 Tsfasman Vladut and Zink using algebraic geometry and ideas of Goppa constructed a seqeunce of codes that exceed the Gilbert Varshamov bound The result was considered sensational Furthermore it was

surprising to see these unrelated areas of mathematics collaborating The aim of this course is to give an introduction to coding theory and to sketch the ideas of algebraic geometry that led to the new result Finally a number of applications of these methods of algebraic geometry to coding theory are given Since this is a new area there are presently no references where one can find a more extensive treatment of all the material However both for algebraic geometry and for coding theory excellent textbooks are available The combination ofthe two subjects can only be found in a number ofsurvey papers A book by C Moreno with a complete treatment of this area is in preparation We hope that these notes will stimulate further research and collaboration of algebraic geometers and coding theorists G van der Geer J H van Lint Introduction to CodingTheory and Algebraic Geometry PartI CodingTheory Jacobus H vanLint 11 1 Finite fields In this chapter we collect without proof the facts from the theory of finite fields that we shall need in this course **Graph Theory, Coding Theory, and Block Designs** Peter Jephson Cameron,Jacobus Hendricus van Lint,1975 These are notes deriving from lecture courses given by the authors in 1973 at Westfield College London The lectures described the connection between the theory of t designs on the one hand and graph theory on the other A feature of this book is the discussion of then recent construction of t designs from codes Topics from a wide range of finite combinatorics are covered and the book will interest all scholars of combinatorial theory **Different Aspects of Coding Theory** Robert Calderbank,1995 The symposia in applied mathematics have been held under the auspices of the American Mathematical Society and others since 1967 This books connects coding theory with actual applications in consumer electronics and with other areas of mathematics It covers in detail the mathematical foundations of digital data storage and makes connections to symbolic dynamics linear systems and finite automata It also explores the use of algebraic geometry within coding theory and examines links with finite geometry statistics and theoretical computer science **Coding Theory** San Ling,Chaoping Xing,2004-02-12 Coding theory is concerned with successfully transmitting data through a noisy channel and correcting errors in corrupted messages It is of central importance for many applications in computer science or engineering This book gives a comprehensive introduction to coding theory whilst only assuming basic linear algebra It contains a detailed and rigorous introduction to the theory of block codes and moves on to more advanced topics like BCH codes Goppa codes and Sudan s algorithm for list decoding The issues of bounds and decoding essential to the design of good codes features prominently The authors of this book have for several years successfully taught a course on coding theory to students at the National University of Singapore This book is based on their experiences and provides a thoroughly modern introduction to the subject There are numerous examples and exercises some of which introduce students to novel or more advanced material *Introduction to Coding Theory* J. H. van Lint,2013-03-09 Coding theory is still a young subject One can safely say that it was born in 1948 It is not surprising that it has not yet become a fixed topic in the curriculum of most universities On the other hand it is obvious that discrete mathematics is rapidly growing in importance The growing need for mathe maticians and computer scientists in industry will

lead to an increase in courses offered in the area of discrete mathematics One of the most suitable and fascinating is indeed coding theory So it is not surprising that one more book on this subject now appears However a little more justification of the book are necessary A few years ago it was and a little more history remarked at a meeting on coding theory that there was no book available an introductory course on coding theory mainly which could be used for for mathematicians but also for students in engineering or computer science The best known textbooks were either too old too big too technical too much for specialists etc The final remark was that my Springer Lecture Notes 201 were slightly obsolete and out of print Without realizing what I was getting into I announced that the statement was not true and proved this by showing several participants the book Inleiding in de Coderingstheorie a little book based on the syllabus of a course given at the Mathematical Centre in Amsterdam in 1975 M C Syllabus 31 **Algebraic Geometric Codes: Basic Notions** Michael A. Tsfasman,Serge G. Vlăduţ,Dmitry Nogin,2007 The book is devoted to the theory of algebraic geometric codes a subject formed on the border of several domains of mathematics on one side there are such classical areas as algebraic geometry and number theory on the other information transmission theory combinatorics finite geometries dense packings etc The authors give a unique perspective on the subject Whereas most books on coding theory build up coding theory from within starting from elementary concepts and almostalways finishing without reaching a certain depth this book constantly looks for interpretations that connect coding theory to algebraic geometry and number theory There are no prerequisites other than a standard algebra graduate course The first two chapters of the book can serve as anintroduction to coding theory and algebraic geometry respectively Special attention is given to the geometry of curves over finite fields in the third chapter Finally in the last chapter the authors explain relations between all of these the theory of algebraic geometric codes **The Big Book of Colleges, 1997** Edward Custard,Princeton Review (Firm),1996-07-30 Lists more than 1 600 colleges and universities and provides information about admissions and academic programs *Who's Who in Science and Engineering 2008-2009* Who's Who Marquis,Marquis Who's Who,2007-12 **A First Course in Coding Theory** Raymond Hill,1991 **Anthropology Newsletter** ,1992

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