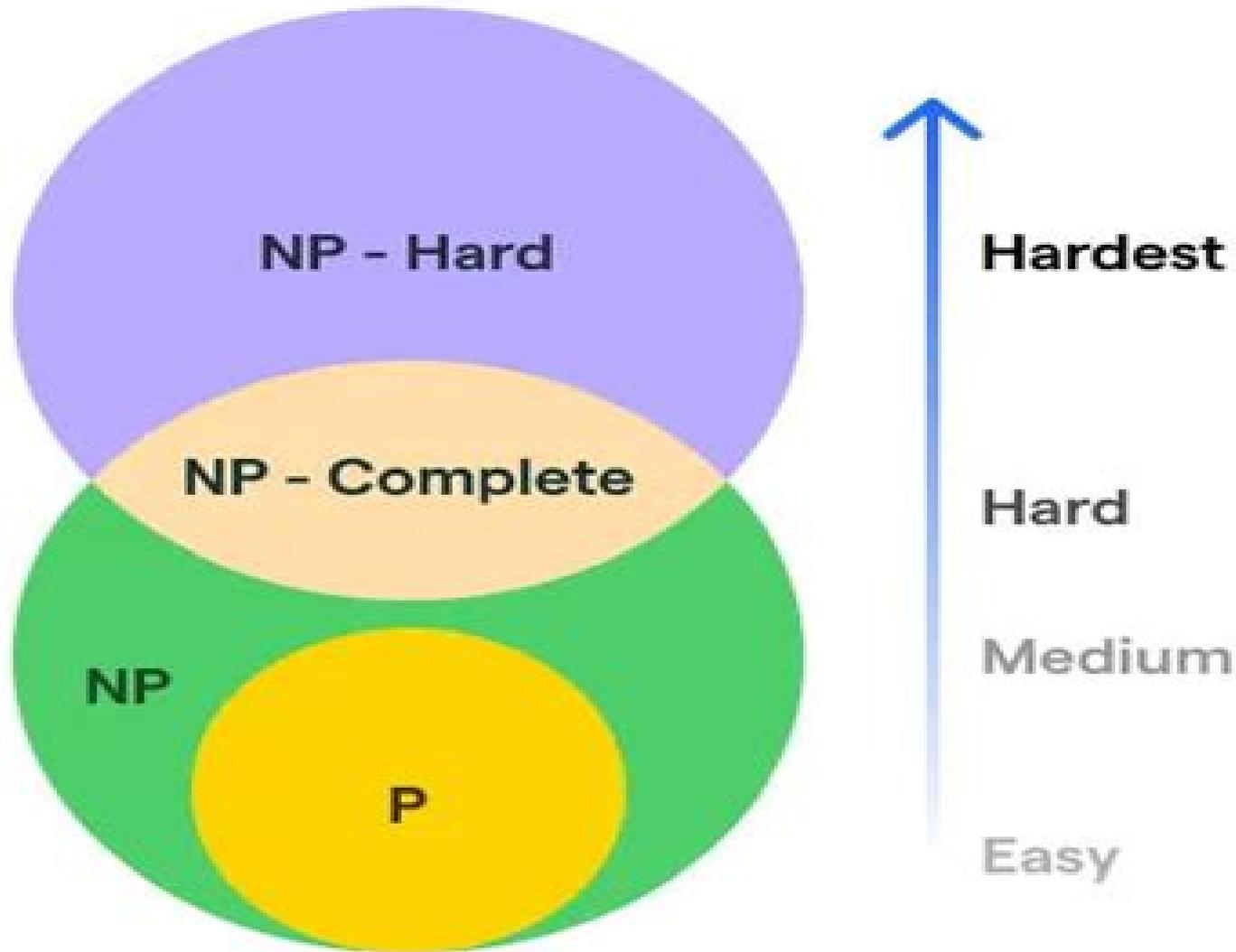


Computational Complexity Theory



Randomness And Completeness In Computational Complexity

R Barnett



Randomness and Completeness in Computational Complexity:

Randomness and Completeness in Computational Complexity Dieter van Melkebeek, 2003-06-29 This book contains a revised version of the dissertation the author wrote at the Department of Computer Science of the University of Chicago. The thesis was submitted to the Faculty of Physical Sciences in conformity with the requirements for the PhD degree in June 1999. It was honored with the 1999 ACM Doctoral Dissertation Award in May 2000. Summary: Computational complexity is the study of the inherent difficulty of computational problems and the power of the tools we may use to solve them. It aims to describe how many resources we need to compute the solution as a function of the problem size. Typical resources include time on sequential and parallel architectures and memory space. As we want to abstract away from details of input representation and specifics of the computer model, we end up with classes of problems that we can solve within certain robust resource bounds such as polynomial time, parallel logarithmic time, and logarithmic space. Research in complexity theory boils down to determining the relationships between these classes, inclusions and separations. In this dissertation, we focus on the role of randomness and look at various properties of hard problems in order to obtain separations. We also investigate the power of nondeterminism and alternation as well as space versus time issues. Randomness provides a resource that seems to help in various situations.

Kolmogorov Complexity and Computational Complexity Osamu Watanabe, 2012-12-06 The mathematical theory of computation has given rise to two important approaches to the informal notion of complexity. Kolmogorov complexity, usually a complexity measure for a single object such as a string, a sequence, etc., measures the amount of information necessary to describe the object. Computational complexity, usually a complexity measure for a set of objects, measures the computational resources necessary to recognize or produce elements of the set. The relation between these two complexity measures has been considered for more than two decades and many interesting and deep observations have been obtained. In March 1990, the Symposium on Theory and Application of Minimal Length Encoding was held at Stanford University as a part of the AAAI 1990 Spring Symposium Series. Some sessions of the symposium were dedicated to Kolmogorov complexity and its relations to the computational complexity theory, and excellent expository talks were given there. Feeling that due to the importance of the material, some way should be found to share these talks with researchers in the computer science community, I asked the speakers of those sessions to write survey papers based on their talks in the symposium. In response, five speakers from the sessions contributed the papers which appear in this book.

13th Annual IEEE Conference on Computational Complexity, 1998 **Theory of Computational Complexity** Ding-Zhu Du, Ker-I Ko, 2014-06-30 Praise for the First Edition: complete up-to-date coverage of computational complexity theory; the book promises to become the standard reference on computational complexity. Zentralblatt MATH: A thorough revision based on advances in the field of computational complexity and readers' feedback. The Second Edition of *Theory of Computational Complexity* presents updates to the principles and applications essential to understanding modern computational complexity.

theory The new edition continues to serve as a comprehensive resource on the use of software and computational approaches for solving algorithmic problems and the related difficulties that can be encountered Maintaining extensive and detailed coverage Theory of Computational Complexity Second Edition examines the theory and methods behind complexity theory such as computational models decision tree complexity circuit complexity and probabilistic complexity The Second Edition also features recent developments on areas such as NP completeness theory as well as A new combinatorial proof of the PCP theorem based on the notion of expander graphs a research area in the field of computer science Additional exercises at varying levels of difficulty to further test comprehension of the presented material End of chapter literature reviews that summarize each topic and offer additional sources for further study Theory of Computational Complexity Second Edition is an excellent textbook for courses on computational theory and complexity at the graduate level The book is also a useful reference for practitioners in the fields of computer science engineering and mathematics who utilize state of the art software and computational methods to conduct research

Algorithmic Randomness Johanna N. Y. Franklin, Christopher P. Porter, 2020-05-07 Surveys on recent developments in the theory of algorithmic randomness and its interactions with other areas of mathematics

Target Tracking with Random Finite Sets Weihua Wu, Hemin Sun, Mao Zheng, Weiping Huang, 2023-08-02 This book focuses on target tracking and information fusion with random finite sets Both principles and implementations have been addressed with more weight placed on engineering implementations This is achieved by providing in depth study on a number of major topics such as the probability hypothesis density PHD cardinalized PHD multi Bernoulli MB labeled MB LMB d generalized LMB d GLMB marginalized d GLMB together with their Gaussian mixture and sequential Monte Carlo implementations Five extended applications are covered which are maneuvering target tracking target tracking for Doppler radars track before detect for dim targets target tracking with non standard measurements and target tracking with multiple distributed sensors The comprehensive and systematic summarization in target tracking with RFSs is one of the major features of the book which is particularly suited for readers who are interested to learn solutions in target tracking with RFSs The book benefits researchers engineers and graduate students in the fields of random finite sets target tracking sensor fusion data fusion information fusion etc

Thirteenth Annual IEEE Conference on Computational Complexity, 1998

Algorithms and Computation, 1994

STACS 2000 Horst Reichel, Sophie Tison, 2007-08-03 This book constitutes the refereed proceedings of the 17th Annual Symposium on Theoretical Aspects of Computer Science STACS 2000 held in Lille France in February 2000 The 51 revised full papers presented together with the three invited papers were carefully reviewed and selected from a total of 146 submissions on the basis of some 700 reviewers reports The papers address fundamental issues from all current areas of theoretical computer science including algorithms data structures automata formal languages complexity verification logic cryptography graph theory optimization etc

Mathematical Foundations of Computer Science 2010 Petr Hlineny, Antonin Kucera, 2010-08-10 This volume

constitutes the refereed proceedings of the 35th International Symposium on Mathematical Foundations of Computer Science MFCS 2010 held in Brno Czech Republic in August 2010 The 56 revised full papers presented together with 5 invited talks were carefully reviewed and selected from 149 submissions Topics covered include algorithmic game theory algorithmic learning theory algorithms and data structures automata grammars and formal languages bioinformatics complexity computational geometry computer assisted reasoning concurrency theory cryptography and security databases and knowledge based systems formal specifications and program development foundations of computing logic in computer science mobile computing models of computation networks parallel and distributed computing quantum computing semantics and verification of programs and theoretical issues in artificial intelligence **STACS 96** Claude Puech,Rüdiger Reischuk,1996-02-14 This book constitutes the refereed proceedings of the 13th Symposium on Theoretical Aspects of Computer Science STACS 96 held in Grenoble France in February 1996 The 52 revised papers presented were selected from a total of 185 submissions also included are three invited papers The volume addresses all current aspects of theoretical computer science and is organized in sections on complexity theory automata theory parallel algorithms learning parallel and distributed systems cryptography logic and database theory algorithms semantics and program verification and communication complexity **Computing** Edward Grady Coffman,J. K. Lenstra,A. H. G. Rinnooy Kan,1992-11-26 Handbook **Computational Complexity** K. Wagner,G. Wechsung,1986-03-31 **Logic and Complexity** Richard Lassaigne,Michel de Rougemont,2012-12-06 Logic and Complexity looks at basic logic as it is used in Computer Science and provides students with a logical approach to Complexity theory With plenty of exercises this book presents classical notions of mathematical logic such as decidability completeness and incompleteness as well as new ideas brought by complexity theory such as NP completeness randomness and approximations providing a better understanding for efficient algorithmic solutions to problems Divided into three parts it covers Model Theory and Recursive Functions introducing the basic model theory of propositional 1st order inductive definitions and 2nd order logic Recursive functions Turing computability and decidability are also examined Descriptive Complexity looking at the relationship between definitions of problems queries properties of programs and their computational complexity Approximation explaining how some optimization problems and counting problems can be approximated according to their logical form Logic is important in Computer Science particularly for verification problems and database query languages such as SQL Students and researchers in this field will find this book of great interest **ECAI 2020** Giuseppe De Giacomo,Bistra Dilkina,Michela Milano,Senén Barro,Alberto Bugarín,Jérôme Lang,2020-09-15 This book presents the proceedings of the 24th European Conference on Artificial Intelligence ECAI 2020 held in Santiago de Compostela Spain from 29 August to 8 September 2020 The conference was postponed from June and much of it conducted online due to the COVID 19 restrictions The conference is one of the principal occasions for researchers and practitioners of AI to meet and discuss the latest trends and challenges in all fields of AI and to demonstrate innovative

applications and uses of advanced AI technology The book also includes the proceedings of the 10th Conference on Prestigious Applications of Artificial Intelligence PAIS 2020 held at the same time A record number of more than 1 700 submissions was received for ECAI 2020 of which 1 443 were reviewed Of these 361 full papers and 36 highlight papers were accepted an acceptance rate of 25% for full papers and 45% for highlight papers The book is divided into three sections ECAI full papers ECAI highlight papers and PAIS papers The topics of these papers cover all aspects of AI including Agent based and Multi agent Systems Computational Intelligence Constraints and Satisfiability Games and Virtual Environments Heuristic Search Human Aspects in AI Information Retrieval and Filtering Knowledge Representation and Reasoning Machine Learning Multidisciplinary Topics and Applications Natural Language Processing Planning and Scheduling Robotics Safe Explainable and Trustworthy AI Semantic Technologies Uncertainty in AI and Vision The book will be of interest to all those whose work involves the use of AI technology

Autoreducibility, Nonuniform Completeness, and Random Oracles Hadi Shafei, 2017 We study the complexity class NP and the NP complete sets The unifying themes in our work are reducibility and randomness which we combine in three distinct ways 1 All known NP complete sets are highly structured with redundancies that make them autoreducible Whether this is true for every NP complete set has important implications for the P vs NP problem We study the autoreducibility of NP complete sets and obtain optimal separations under strong hypotheses for NP Under largeness hypotheses for NP we show that adding a single query to an autoreduction with bounded number of queries makes it stronger We also prove that autoreductions with constant number of queries are strictly weaker than autoreductions where the number of queries is unbounded 2 Nonuniformity is a central concept in computational complexity with powerful connections to circuit complexity and randomness Nonuniform reductions have been used to study the isomorphism conjecture for NP and completeness for larger complexity classes We study the power of nonuniform reductions for NP completeness obtaining both separations and upper bounds for nonuniform completeness vs uniform completeness in NP Under largeness hypotheses on NP we show that nonuniform reductions that use a single bit of advice are stronger than uniform reductions On the other hand we prove that if the length of advice is logarithmic then by increasing the number of queries nonuniformity can be eliminated We also show that this is not true in general In particular if the length of the advice is polynomial nonuniformity cannot be eliminated As a result we separate nonuniform reductions with logarithmic advice from nonuniform reductions with polynomial advice 3 Bennett and Gill proved that P NP relative to random oracles In other words the class of oracles where PA NPA has measure 1 with respect to classical Lebesgue measure on infinite binary sequences We show that the class of oracles where PA NPA is small with respect to p measure and p betting game measure This can be considered as the first step towards separating different levels of polynomial hierarchy relative to p random oracles

Mathematical Foundations of Computer Science, 2004 [Computational Complexity: A Quantitative Perspective](#) Marius Zimand, 2004-07-07 There has been a common perception that computational complexity is a theory of

bad news because its most typical results assert that various real world and innocent looking tasks are infeasible In fact bad news is a relative term and indeed in some situations e g in cryptography we want an adversary to not be able to perform a certain task However a bad news result does not automatically become useful in such a scenario For this to happen its hardness features have to be quantitatively evaluated and shown to manifest extensively The book undertakes a quantitative analysis of some of the major results in complexity that regard either classes of problems or individual concrete problems The size of some important classes are studied using resource bounded topological and measure theoretical tools In the case of individual problems the book studies relevant quantitative attributes such as approximation properties or the number of hard inputs at each length One chapter is dedicated to abstract complexity theory an older field which however deserves attention because it lays out the foundations of complexity The other chapters on the other hand focus on recent and important developments in complexity The book presents in a fairly detailed manner concepts that have been at the centre of the main research lines in complexity in the last decade or so such as average complexity quantum computation hardness amplification resource bounded measure the relation between one way functions and pseudo random generators the relation between hard predicates and pseudo random generators extractors derandomization of bounded error probabilistic algorithms probabilistically checkable proofs non approximability of optimization problems and others The book should appeal to graduate computer science students and to researchers who have an interest in computer science theory and need a good understanding of computational complexity e g researchers in algorithms AI logic and other disciplines Emphasis is on relevant quantitative attributes of important results in complexity Coverage is self contained and accessible to a wide audience Large range of important topics including derandomization techniques non approximability of optimization problems average case complexity quantum computation one way functions and pseudo random generators resource bounded measure and topology

Workshop on Physics and Computation ,1994 Proceedings of the November 1994 workshop highlighting the potential impact of physics and computation research on the semiconductor and computer industries in this decade Subjects include nanoelectronics computing with quantum devices architecture issues in nanoelectronics and computation quan

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