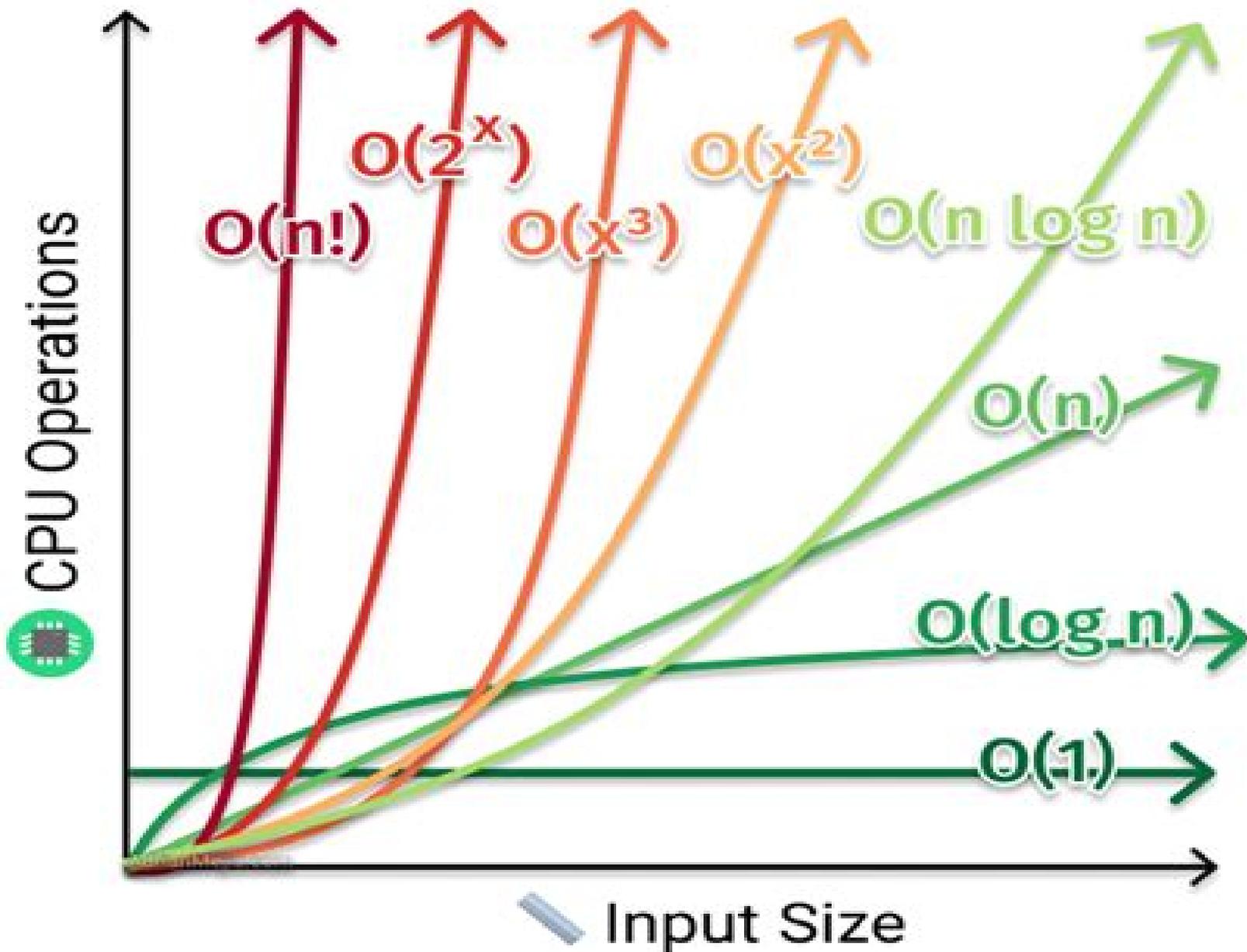# ⏱ Time Complexity

Complexity Of Boolean Functions

Paul E. Dunne

Complexity Of Boolean Functions:

   The Complexity of Boolean Functions Ingo Wegener,1987 Presents a large number of recent research results previously unavailable in book form Initially deals with the wee known computation models and goes on to special types of circuits parallel computers and branching programs Includes basic theory as well recent research findings Each chapter includes exercises   **Boolean Function Complexity** Michael S. Paterson,1992-11-05 By considering the size of the logical network needed to perform a given computational task the intrinsic difficulty of that task can be examined Boolean function complexity the combinatorial study of such networks is a subject that started back in the 1950s and has today become one of the most challenging and vigorous areas of theoretical computer science The papers in this book stem from the London Mathematical Society Symposium on Boolean Function Complexity held at Durham University in July 1990 The range of topics covered will be of interest to the newcomer to the field as well as the expert and overall the papers are representative of the research presented at the Symposium Anyone with an interest in Boolean Function complexity will find that this book is a necessary purchase   **Boolean Function Complexity** Stasys Jukna,2012-01-06 Boolean circuit complexity is the combinatorics of computer science and involves many intriguing problems that are easy to state and explain even for the layman This book is a comprehensive description of basic lower bound arguments covering many of the gems of this complexity Waterloo that have been discovered over the past several decades right up to results from the last year or two Many open problems marked as Research Problems are mentioned along the way The problems are mainly of combinatorial flavor but their solutions could have great consequences in circuit complexity and computer science The book will be of interest to graduate students and researchers in the fields of computer science and discrete mathematics   *Complexity Measures of Boolean Functions and Their Applications* Siddhesh Prashant Chaubal,2020 The central focus of computational complexity theory is to measure the hardness of computing different functions Towards this end several measures of complexity for Boolean functions have been studied over the past few decades Examples of important complexity measures include sensitivity block sensitivity certificate complexity decision tree complexity and degree Studying the relationships between these different measures has been an active area of research In the first part of this dissertation we prove several results towards tightening the relationships between some of these measures particularly the sensitivity and block sensitivity Specifically we prove better cubic and sometimes quadratic upper bounds on block sensitivity in terms of sensitivity for certain classes of transitive functions We also prove tight lower bounds on the block sensitivity for the classes we consider In the other direction we give various new constructions of families of Boolean functions that exhibit quadratic separation between sensitivity and block sensitivity Our constructions have several novel aspects For example we give the first direct constructions of families of Boolean functions that have both 0 block sensitivity and 1 block sensitivity quadratically larger than sensitivity In the next part of this dissertation we introduce a new complexity measure of Boolean functions we call

diameter that captures the relationship between certificate complexity and several other measures of Boolean functions We argue that estimating diameter may help to get improved bounds on certificate complexity in terms of sensitivity and other measures Further we prove tight bounds on the sensitivity and block sensitivity of transitive functions with constant diameter We also prove some implications for the log rank conjecture in communication complexity for XOR functions with bounded diameter In the last part of this dissertation we study applications of the relationship between some of these measures to machine learning Specifically we contribute towards two problems concerning decision trees as a machine learning model First we focus on the problem of modifying a given decision tree classifier to optimize a specific evaluation measure the recall of the classifier under some constraints Finally we present some algorithms for decision trees for regression problems in the context of transfer learning **Average Case Complexity for Finite Boolean Functions** A.V. Chashkin,2018 The average time of computing Boolean functions by straight line programs with a conditional stop is considered A straight line program consists of operators of two types Every operator of the first type computes a binary Boolean function whose arguments are either the values computed by preceding operators or the values of the input variables Every operator of the second type either terminates program execution or commands that the next operator is executed A measure of the complexity of such programs is the average execution time over all tuples of the input variables The complexity of computing almost all complete Boolean functions and almost all partial Boolean functions by such programs is proved to coincide up to a multiplicative constant with conventional circuit complexity Moreover these complexities are proved to differ up to a multiplicative constant by a factor of for almost all place Boolean functions equal to 1 on tuples The existence of Boolean functions of variables is proved for which the average execution time is less up to a multiplicative constant by a factor of 2 than the time required to compute them by conventional straight line programs Boolean Functions and Computation Models Peter Clote,Evangelos Kranakis,2002-09-19 The two internationally renowned authors elucidate the structure of fast parallel computation Its complexity is emphasised through a variety of techniques ranging from finite combinatorics probability theory and finite group theory to finite model theory and proof theory Non uniform computation models are studied in the form of Boolean circuits uniform ones in a variety of forms Steps in the investigation of non deterministic polynomial time are surveyed as is the complexity of various proof systems Providing a survey of research in the field the book will benefit advanced undergraduates and graduate students as well as researchers *Lower Bounds for the Complexity of Restrictions of Boolean Functions* A.V. Chashkin,2018 The complexity of restrictions of Boolean functions is studied in various computational models Lower bounds for the complexity of the most complicated restrictions to domains of fixed size are established The complexity bounds are shown to be tight up to a constant multiplicative factor in the case of logic circuits For every Boolean function of variables whose circuit size is greater than where is an arbitrary positive constant it is proved that there exists a domain in 0 1 the restriction to which has a nonlinear circuit size that differs by a constant

factor from the circuit size of the most complicated partial Boolean function defined on this domain Any Boolean function of variables is proved to be uniquely determined by its values in no more than domains whose sizes are bounded from above by the product of the function complexity and **The Complexity of Boolean Networks** Paul E. Dunne,1988

Introduction to Circuit Complexity Heribert Vollmer,1999-06-23 An advanced textbook giving a broad modern view of the computational complexity theory of boolean circuits with extensive references for theoretical computer scientists and mathematicians **Lower Bounds on the Complexity of Boolean Functions** Uri Zwick,1989 **Data Structures, Minimization and Complexity of Boolean Functions** ,1996 Boolean function manipulation is an important component of computer science This thesis presents results related to Boolean function representation and minimization The Boolean function minimization problem is re defined A new Boolean function classification theory based on permutation and extension is developed More efficient Boolean function minimization algorithms can be derived based on the classification theory The thesis also examines the complexity issues and graph structure of OBDDs of some special Boolean functions Moreover some new data structures for Boolean functions are reported in this thesis Some functions are found to have constant complexity in the new data structure while having exponential complexity in existing data structures **The Monotone Circuit Complexity of Boolean Functions** International Business Machines Corporation. Research Division,N. Alon,R. B. Boppana,1986 **Complexity of Boolean Functions** David Mix Barrington,Rüdiger Reischuk,Ingo Wegener,2000 **Gate Complexity of Boolean Functions** Karin Sommer,Joachim Rosenthal,2010 *An Introduction to Boolean Function Complexity* Michael S. Paterson,1976 The complexity of a finite Boolean function may be defined with respect to its computation by networks of logical elements in a variety of ways The three complexities of circuit size formula size and depth are considered and some of the principal results concerning their relationships and estimations are presented with outlined proofs for some of ths simpler theorems This survey is restricted to networks in which all two argument logical functions may be used **Models of Query Complexity for Boolean Functions** Sourav Chakraborty,2010-08 In this thesis we study various models of query complexity A query algorithm computes a function under the restriction that the input can be accessed only by making probes to the the bits of the input The query complexity of a function f is the minimum number of probes made by any query algorithm that computes f In this thesis we consider three different models of query complexity 1 deterministic decision tree complexity query complexity when the underlying algorithm is deterministic 2 approximate decision tree complexity aka property testing query complexity when the underlying algorithm is probabilistic and only expected to approximately compute f and quantum query complexity query complexity when the underlying algorithm is allowed to make quantum queries **Mathematical Foundations of Computer Science 2003** Branislav Rovan,Peter Vojtas,2003-12-03 This book constitutes the refereed proceedings of the 28th International Symposium on Mathematical Foundations of Computer Science MFCS 2003 held in Bratislava Slovakia in August 2003 The 55 revised full papers presented together with 7 invited

papers were carefully reviewed and selected from 137 submissions All current aspects in theoretical computer science are addressed ranging from discrete mathematics combinatorial optimization graph theory networking algorithms and complexity to programming theory formal methods and mathematical logic *Computing and Combinatorics* Fedor V. Fomin,Mingyu Xiao,2025-09-01 This two volume set LNCS 15983 and 15984 constitutes the referred proceedings of the 31st International Computing and Combinatorics Conference COCOON 2025 held in Chengdu China during August 15 17 2025 The 54 full papers were carefully reviewed and selected from 191 submissions COCOON 2025 provided an excellent venue for researchers working in the topical sections as follows Part I Approximation Algorithms Combinatorial Optimization Computational Complexity Computational Geometry Economics and Computation Part II Graph Algorithms and Graph Theory Learning and Data Related Theory Parameterized Algorithms String Algorithms and Discrete Structures **Complexity of Linear Boolean Operators** Stasys Jukna,Igor Sergeev,2013-10 Complexity of Linear Boolean Operators is the first thorough survey of the research in this area The book is intended for students and researchers in discrete mathematics and theoretical computer science **2.25 N-lower Bound on the Combinational Complexity of Boolean Functions** Cornell University. Department of Computer Science,Wolfgang J. Paul,1974 Consider the combinational complexity L_f of Boolean functions over the basis Omega f f 0 1 superscript 2 rightarrow 0 1 A new Method for proving linear lower bounds of size $2n$ is presented Combining it with methods presented in 7 and 9 we establish for a special set of functions f superscript n 0 1 2 $25n \leq L_f \leq 6n$

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