Descriptive Complexity

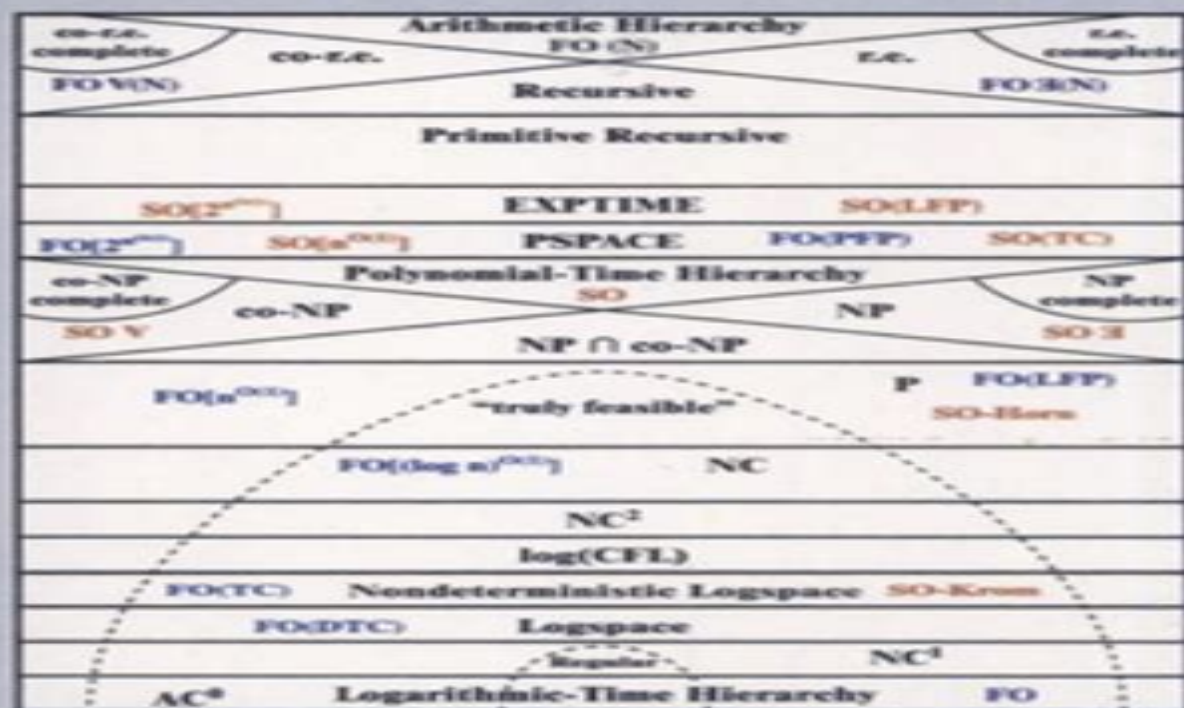| co-r.e. complete | co-r.e. | Arithmetic Hierarchy FO (N) | | r.e. | r.e. complete |
FO ∀(N)		Recursive			FO ∃(N)
		Primitive Recursive			
SO[2^{n^{O(1)}}]		EXPTIME		SO(LFP)	
FO[2^{n^{O(1)}}]	SO[n^{O(1)}]	PSPACE	FO(PFP)	SO(TC)	
co-NP complete	co-NP	Polynomial-Time Hierarchy SO	NP		NP complete
SO ∀		NP ∩ co-NP			SO ∃
FO[n^{O(1)}]	"truly feasible"		P	FO(LFP) SO-Horn	
	FO[log n^{O(1)}]	NC			
	NC^2				
	log(CFL)				
FO(TC)	Nondeterministic Logspace		SO-Krom		
FO(DTC)	Logspace				
	Regular	NC^1			
AC^0	Logarithmic-Time Hierarchy		FO		

Neil Immerman

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Martin Grohe

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Descriptive Complexity Neil Immerman,1998-11-20 By virtue of the close relationship between logic and relational databases it turns out that complexity has important applications to databases such as analyzing the parallel time needed to compute a query and the analysis of nondeterministic classes This book is a relatively self contained introduction to the subject which includes the necessary background material as well as numerous examples and exercises **Descriptive Complexity, Canonisation, and Definable Graph Structure Theory** Martin Grohe,2017-08-17 Descriptive complexity theory establishes a connection between the computational complexity of algorithmic problems the computational resources required to solve the problems and their descriptive complexity the language resources required to describe the problems This groundbreaking book approaches descriptive complexity from the angle of modern structural graph theory specifically graph minor theory It develops a definable structure theory concerned with the logical definability of graph theoretic concepts such as tree decompositions and embeddings The first part starts with an introduction to the background from logic complexity and graph theory and develops the theory up to first applications in descriptive complexity theory and graph isomorphism testing It may serve as the basis for a graduate level course The second part is more advanced and mainly devoted to the proof of a single previously unpublished theorem properties of graphs with excluded minors are decidable in polynomial time if and only if they are definable in fixed point logic with counting **Descriptive Complexity and Finite Models** Neil Immerman,Phokion Kolaitis,1997-01-01 This volume presents articles by leading researchers who delivered talks at the Workshop on Finite Models and Descriptive Complexity at Princeton in January 1996 during a DIMACS sponsored Special Year on Logic and Algorithms Each article is self contained and provides a valuable introduction to the featured research areas connected with finite model theory **Ordering and Descriptive Complexity** Kousha Etessami,1995 *Descriptive Complexity and Finite Models* Neil Immerman,1997 We hope that this small volume will suggest directions of synergy and contact for future researchers to build upon creating connections and making discoveries that will help explain some of the many mysteries of computation The Preface Finite model theory can be succinctly described as the study of logics on finite structures It is an area of research existing between mathematical logic and computer science This area has been developing through continuous interaction with computational complexity database theory and combinatorics The volume presents articles by leading researche *Small Dynamic Complexity Classes* Thomas Zeume,2017-02-15 Small Dynamic Complexity Classes was awarded the E W Beth Dissertation Prize 2016 for outstanding dissertations in the fields of logic language and information The thesis studies the foundations of query re evaluation after modifying a database It explores the structure of small dynamic descriptive complexity classes and provides new methods for proving lower bounds in this dynamic context One of the contributions to the former aspect helped to confirm the conjecture by Patnaik and Immerman 1997 that reachability can be maintained by first order update formulas **Descriptive Complexity for**

Counting Complexity Classes Martín Alonso Muñoz Cruces,2017 La complejidad descriptiva ha sido muy exitosa en caracterizar clases de complejidad de decisi n en t rminos de propiedades definibles en algunas l gicas Sin embargo la complejidad descriptiva para clases de complejidad de conteo como FP y P no ha sido estudiada sistem ticamente y no est tan desarrollada como su an logo de decisi n En este art culo proponemos un marco te rico basado en l gicas con peso para tratar este problema Espec ficamente al enfocarnos en los n meros naturales obtenemos una l gica llamada L gica de Segundo Orden Cuantitativa QSO y mostramos c mo algunos de sus fragmentos pueden ser usados para capturar clases de complejidad de conteo fundamentales como FP P y FPSPACE entre otras Tambi n usamos QSO para definir una jerarqu a dentro de P identificando clases de complejidad de conteo con buenas propiedades de clausura y aproximaci n y que admiten problemas completos naturales Finalmente a adimos recursi n a QSO y mostramos c mo esta extensi n captura naturalmente clases de complejidad de conteo inferiores como L   *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   Investigations in the Theory of Descriptive Complexity William L. Gewirtz,2018-03-02 This work has been selected by scholars as being culturally important and is part of the knowledge base of civilization as we know it This work was reproduced from the original artifact and remains as true to the original work as possible Therefore you will see the original copyright references library stamps as most of these works have been housed in our most important libraries around the world and other notations in the work This work is in the public domain in the United States of America and possibly other nations Within the United States you may freely copy and distribute this work as no entity individual or corporate has a copyright on the body of the work As a reproduction of a historical artifact this work may contain missing or blurred pages poor pictures errant marks etc Scholars believe and we concur that this work is important enough to be preserved reproduced and made generally available to the public We appreciate your support of the preservation process and thank you for being an important part of keeping this knowledge alive and relevant   *Systems of Bounded Arithmetic from*

Descriptive Complexity [microform] Antonina Kolokolova,2005 In this thesis we discuss a general method of constructing systems of bounded arithmetic from descriptive complexity logics of known complexity We discuss the conditions under which the resulting systems capture the same complexity class in the bounded arithmetic setting as the corresponding logic in the descriptive complexity setting Our method works for small complexity classes P and below which have simple proofs of closure under complementation Additionally we require proofs of membership and co membership for instances of decision problems to be constructible within the same complexity class Based on this general theorem we discuss systems of arithmetic for classes P and NL We also give a system of arithmetic for SL although the definability theorem for SL is weaker More formally given a logic L capturing complexity class C the corresponding second order system V L of arithmetic consists of a system for AC 0 together with comprehension over L formulae If the class is provably in V L closed under AC 0 reductions and every formula or its possibly semantic negation can be witnessed in C then the resulting system captures C
    Fixed-point Logics, Descriptive Complexity, and Random Satisfiability Albert Atserias,2002   **Investigations in the Theory of Descriptive Complexity (Classic Reprint)** William L. Gewirtz,2015-08-04 Excerpt from Investigations in the Theory of Descriptive Complexity Introduction 1 Fundamental Notations Definitions and Results of Descriptive Complexity 1 1 Notational Conventions 1 2 Fundamental Definitions and Results of the Kolmogorov Formulations 1 3 Chaitin s Formulation of Descriptive Complexity 1 4 Elementary Theorems Relating the Kolmogorov and Chaitin Formulations 1 5 Recursive and Recursively Enumerable Sequences 2 Infinite Random Sequences 2 1 Basic Definitions and Results of the Kolmogorov Formulation 2 2 Chaitin s Proposed Definitions 2 3 A Definition Based on Chaitin s Formulation 2 4 Recursive and Recursively Enumerable Subsequences 3 An Analysis Of K s s 3 1 The Set of Optimal Programs 3 2 K s s 5 Subrecursive Formulations Of Descriptive Complexity 5 1 Introduction and Fundamental Definitions 5 3 A Hierarchy of Random Sequences 5 4 The Maximum Grzegorczyk Level of All Programs of Length Less than n 5 5 The Longest String of Complexity Less than n Notes Bibliography About the Publisher Forgotten Books publishes hundreds of thousands of rare and classic books Find more at www forgottenbooks com This book is a reproduction of an important historical work Forgotten Books uses state of the art technology to digitally reconstruct the work preserving the original format whilst repairing imperfections present in the aged copy In rare cases an imperfection in the original such as a blemish or missing page may be replicated in our edition We do however repair the vast majority of imperfections successfully any imperfections that remain are intentionally left to preserve the state of such historical works   **Descriptive Complexity of Constraint Problems** Pengming Wang,2018
    Descriptive Complexity Martin Grohe,2017   **Engineering Informatics** Benny Raphael,Ian F. C. Smith,2013-05-29 Computers are ubiquitous throughout all life cycle stages ofengineering from conceptual design to manufacturing maintenance repair and replacement It is essential for all engineers tobe aware of the knowledge behind computer based tools andtechniques they are likely to encounter The computationaltechnology which allows engineers to carry out design

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Consciousness as Complex Event Craig Delancey,2022-09-09 Consciousness as Complex Event Towards a New Physicalism provides a new approach to the study of consciousness The author argues that what makes phenomenal experiences mysterious is that these experiences are extremely complex brain events The text provides an accessible introduction to descriptive complexity also known as Kolmogorov Complexity and then applies this to show that the most influential arguments against physicalism about consciousness are unsound The text also offers an accessible review of the current debates about consciousness and introduces a rigorous new conception of physicalism It concludes with a positive program for the future study of phenomenal experience It is readable and compact and will be of interest to philosophers and cognitive scientists and of value to advanced students of philosophy Key Features Provides a new approach to the study of consciousness using information theory Offers a valuable discussion of physicalism of use in other disciplines Contains an introduction to the main literature and arguments in the debate about consciousness Includes an accessible overview of how to apply descriptive complexity to philosophical problems   Descriptive Complexity and the W Hierarchy Rod Downey,Michael Ralph Fellows,Kenneth W. Regan,Victoria University of Wellington. Mathematics Department,1996   *The descriptive complexity of the fixed-points of bounded formulas* Albert Atserias,2000   An Introduction to Design Arguments Benjamin C. Jantzen,2014-02-27 A comprehensive survey of the many different forms of design argument for the existence of God   Computer Science Logic Jörg Flum,Mario Rodriguez-Artalejo,2003-07-31 The 1999 Annual Conference of the European Association for Computer Science Logic CSL 99 was held in Madrid Spain on September 20 25 1999 CSL 99 was

the 13th in a series of annual meetings originally intended as Internat nal Workshops on Computer Science Logic and the 8th to be held as the nual Conference of the EACSL The conference was organized by the Computer Science Departments DSIP and DACYA at Universidad Complutense in M rid UCM The CSL 99 program committee selected 34 of 91 submitted papers for p sentation at the conference and publication in this proceedings volume Each submitted paper was refereed by at least two and in almost all cases three di erent referees The second refereeing round previously required before a per was accepted for publication in the proceedings was dropped following a decision taken by the EACSL membership meeting held during CSL 98 Brno Czech Republic August 25 1998

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