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Essays Dedicated to Dexter Kozen
on the Occasion of His 60th Birthday

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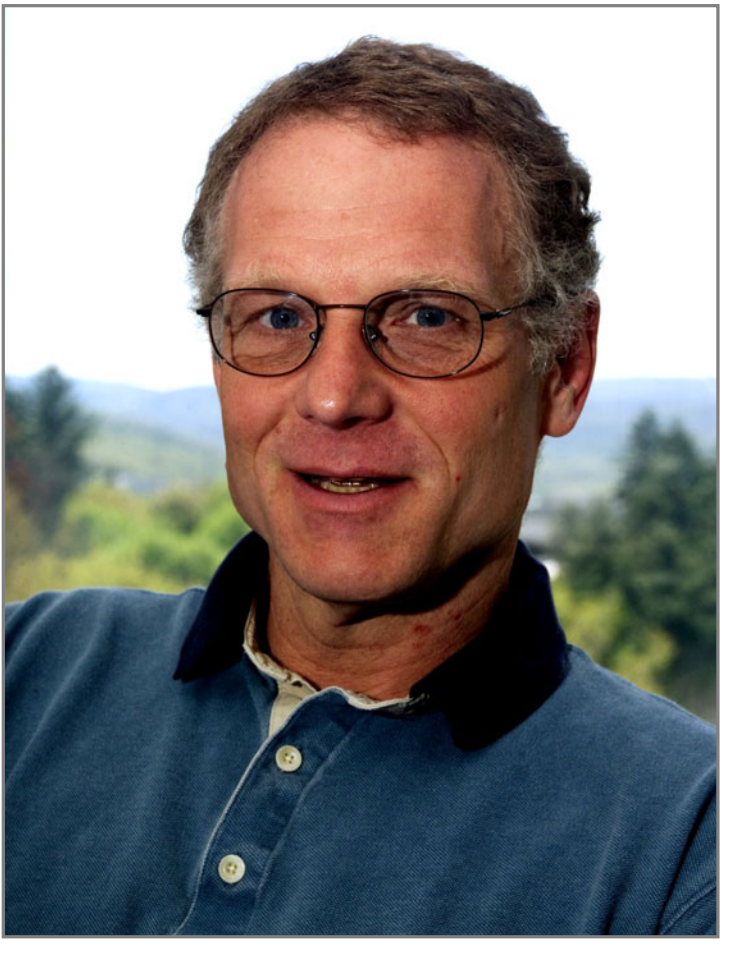

Dexter Kozen

Preface

Dexter Kozen is a personal force in computer science. Even those who have met him only once come away with an almost physical sense of his intellectual horsepower, his boundless energy, and his intellectual depth. The contributors to this volume bear witness to his influence, and their eagerness to join us in this enterprise confirmed our expectations that we would attract a diverse and enthusiastic group of authors, revealing the vast range of Dexter's interests and contributions. One of the two editors has known Dexter longer than the other one has known her parents. Both of them will add their *laudatios* in this Preface. First we introduce the wide spectrum of contributions in this volume that reflect the breadth of Dexter's work and influence.

Dexter has been a leader in the development of Kleene Algebras (KAs), and the article by Andreka, Mikulas, and Nemeti presents a new result on axiomatizing Residuated Kleene Algebras. The paper by Kupke and Rutten looks at a coalgebraic approach to automatic sequences. Dexter was inspired by the work of Rutten and his coauthors to examine a coalgebraic approach to KAs with tests (KATs). His interest in coalgebraic methods attracted the article by Bonchi, Bonsangue, Rutten, and Silva on Brzozowski's minimization algorithm for finite automata. This looks like another algorithm that is ripe for formalization and perhaps for extraction from a formal proof as was done for the minimization algorithm in the classic 1969 textbook of Hopcroft and Ullman, *Formal Languages and Their Relation to Automata* using the Nuprl prover. Dexter's results on congruence closure have been used in the Nuprl system for years, invoked thousands of times a week at Cornell alone. The article by Kreitz discusses other ways in which Nuprl has been a formal partner in Dexter's work, a kind of self application of Kozen to Kozen. Indeed, we thought of writing an article on the formal results in the Nuprl digital library that are related to Dexter's work, but then we saw that these connections would be manifest in this collection. The article by Jeannin on capsules is another example where the elegance of ideas that Dexter develops with his students influence implementation work at Cornell and elsewhere.

The article by Panangaden, Knight, and Mardare on completeness of epistemic logic represents another topic on which Dexter has done influential work, namely, the completeness of various programming logics. In the same topic, the paper by Moss, Wennstrom, and Whitney presents a complete logical system for the equality of recursive terms for sets. This theme is closely related to the theme of finding decision procedures for logics as presented in the article by Rehof and Urzyczyn. This article uses results on alternation, a topic of Dexter's research for which he won the Outstanding Innovation Award from IBM in 1980. Another work related to alternation is the paper by Michalewski and Niwinski. Still related to logic, the volume includes two papers on game semantics. The paper

by Winskel presents a bicategorical formulation of games representing concurrent programs and processes. Parikh, Tasdemir, and Witzel discuss choice and uncertainty in games.

Donald discusses in detail the impact that one of the first papers of Dexter, "On the Power of the Compass," co-authored with Manuel Blum, has had in robotics and nanoscience. This work fits in another field where Dexter has made pioneering contributions, namely, in the area of (algebraic) algorithms and complexity. In the same topic fit the paper by Palsberg, who presents a tutorial proof that overloading is NP-complete, the paper by Carmosino, Immerman, and Jordan, on descriptive complexity, presenting a tool for performing research and learning about finite model theory, and also the papers by Chen and Sharp. Chen's paper discusses the complexity of the quantified constraint satisfaction problem on finite structures and Sharp discusses the complexity of distance coloring in graphs.

It is gratifying to see papers from three of Dexter's graduated PhD students, Hubie Chen, Neal Glew, and Alexa Sharp. We discussed above the papers by Chen and Sharp. Glew's paper, on subtyping and equirecursive types, is a prime example of another area in which Dexter has worked, namely, programming languages and program analysis.

The volume also includes articles not directly related to Dexter's research but which add to the feeling of diversity that has always characterized his science. Salomaa, who investigated in the past one of Dexter's favorite research topics (completeness of KAs), presents a paper where he studies reaction systems useful to model biochemical reactions. Gorecki and Tiuryn, the latter co-author, with Dexter and David Harel, of a book on dynamic logic, present a quite elaborate paper on phylogenetics.

The second part of this volume includes *laudatios* from several collaborators, students and friends, including the members of his current band. The two editors add their *laudatios* below.

The first editor has known Dexter since 1976 when Juris Hartmanis brought Dexter to his office and said something like, "Here is a very clever chap, one of my PhD students, that you should know since he is also interested in the kind of thing you do." I think Juris might have added "strange as that kind of thing is." It didn't take me long to see this truth, and my students and I were implementing his very clever congruence closure algorithm in our PLCV Programming Logic system by 1978. We have kept that algorithm as a part of our interactive provers ever since, modifying it to handle types as our systems evolved. Over the years my students and I have been influenced by countless ideas and insights from Dexter. More broadly, the students at Cornell universally admire Dexter for his exceptionally precise and clear lectures. Their style can be seen in the four textbooks Dexter has written: *The Design and Analysis of Algorithms*, *Automata and Computability*, *Dynamic Logic* (with Harel and Tiuryn), and *Theory of Computation* – all but one published by Springer. I have taught from his unpublished lecture notes as well, and that is a remarkable experience. Everything is perfectly explained. It is no wonder that he is regarded

by so many Cornell students as the best teacher that ever taught them. All of Dexter's colleagues have benefited from his extraordinary teaching ability and from his books and polished lecture notes. Those of us who have played ultimate frisbee, hockey, and tennis with Dexter know that he is also a remarkable athlete who can then step from the hockey rink to the stage and wow an audience with his musical talents. Dexter is one of a kind.

The second editor met Dexter in Amsterdam when she was a first-year insecure PhD student. Talking to Dexter for the first time was a revealing moment, and after just a few minutes into the conversation she realized how much more than only a brilliant researcher Dexter was. His ability to explain a solution to a problem is astonishing and reading his papers was a great learning tool along the years. The months she spent in Ithaca after her PhD were great in many ways, and she is grateful to Dexter and Fran for having made all the efforts to make her, and later Jan Rutten and Marcello Bonsangue, welcome in the Finger Lakes' region. From the many valuable lessons she learned from Dexter, she chooses one to share with the readers: *a beautiful result deserves a beautiful proof*. Dexter puts an amazing energy into everything he does and she is proud to know him and to have been given the opportunity to work with him. She wishes him all the best for the many years to come!

We are grateful to everyone who has participated in putting together this volume and the symposium in honor of Dexter. We thank all the authors for writing wonderful papers that will certainly delight Dexter and also for helping us with the reviewing process. Several people at Cornell, including Michelle Eighmey, Jim Entwood, Tammy Gardner, Joe Halpern and Juris Hartmanis, deserve a special mention for all their efforts in the organization of the symposium. We also thank everyone at Springer, most notably Alfred Hofmann and Anna Kramer, who embraced this project with enthusiasm and helped us in composing the book.

We use the title of one of the laudatios in this volume, by David Harel, to conclude this preface. It has been our greatest pleasure to organize this volume as a tribute to *Dexter Kozen – A Winning Combination of Brilliance, Depth, and Elegance*.

April 2012

Robert L. Constable
Alexandra Silva

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