

Preface

This Festschrift is an appreciative worldwide scientific community's fitting recognition of the outstanding mathematical and theoretical computer science contributions made by Rodney Downey. It was presented at a celebratory "RodFest," an International Computability and Complexity Symposium that took place in the town of Raumati Beach outside of Wellington, with many of the authors gathered to wish him a happy birthday. The volume contains contributions from invited speakers and papers that present original unpublished research or expository and survey results in the following areas in which Rod Downey has had significant interests: Turing degrees, computably enumerable sets, computable algebra, computable model theory, algorithmic randomness, reverse mathematics, and parameterized complexity.

As Rod turns 60, there is much to celebrate. He has advanced our understanding of several areas of mathematics and computer science. His students and postdocs have gone on to become some of the finest scientists in the world. Rod's colleagues find him supportive and energetic, always with a wealth of new ideas and valuable insights. Rod's work with mathematical associations, organizing conferences and joint meetings, and bringing in world-class scientists has changed New Zealand's mathematical landscape.

Rod's mentoring often includes helmeted surfing in New Zealand's rocky waves and Scottish country dancing. Perhaps the body-boarding helps build the courage needed for mathematical research. Rod's wife, Kristin, introduced him to Scottish country dancing, and he is now a teacher and active in the dance community both locally and internationally. Rod has written three books and devised over 80 dances, accompanied by detailed notes and history, with some on YouTube. The cover picture on this Festschrift is of a popular dance progression, La Spirale, devised by Rod in 1998 and used in many dances.

Building on the work of Church, Gödel, Turing, and others, Rod has developed exciting interactions between computability, complexity, and randomness. This line of research applying algorithmic information theory/Kolmogorov complexity and the incompressibility method to recursion theory in the analysis of notions of randomness, still holding many open problems, is described in the survey by Hirschfeldt. Rod has received many honours and awards, including the Royal Society of New Zealand Hector Medal for outstanding, internationally acclaimed work in recursion theory, computational complexity, and other aspects of mathematical logic and combinatorics. The surveys and articles in this Festschrift are a fitting tribute to Rod's many significant and deep contributions.

Rod is cofounder, together with Mike Fellows, of the highly successful field of parameterized/multivariate complexity. Parameterized complexity is a two-dimensional refinement of classical complexity, where instance complexity is measured by both the size of the input and by a problem-specific parameter. With this fine-grained analysis, normally intractable problems can be solved efficiently provided the parameter is not

too large. The story of Rod and Mike's collaboration is well told by Rod in Mike's Festschrift (Springer LNCS 7370) and in Mike's article herein.

In the area of mathematics popularization, Rod's lectures on Turing have drawn large crowds. He has also contributed to the Mathreach Project. In his video interview called "Complexity, Computation and a Bit of Fuzzy Logic," Rod describes the use of mathematics in areas as diverse as industrial smelting, computer chip manufacturing, and tumble drier sensors.

We would like to thank all the contributors to this Festschrift both for their scientifically interesting articles as well as for their enthusiasm to contribute. The positive and immediate response to our invitations made assembling this volume a joyful experience for us. We are very thankful to all the authors and to the many reviewers, who made the excellent articles even better, to Kristin Downey, who sourced many photos, and to Mateus de Oliveira Oliveira for help in many ways. We are indebted to Alfred Hofmann at Springer for his feedback, and to Springer for giving us the possibility to publish this Festschrift in their *Lecture Notes in Computer Science* series. We especially thank Anna Kramer and Ronan Nugent and all those at Springer for their gracious help and advice.

With this book we celebrate Rod's vision and achievements, and honor this eminent scientist who we are privileged to have as mentor, teacher, and friend.

Happy Birthday, Rod!

January 2017

Adam Day
Michael Fellows
Noam Greenberg
Bakhadyr Khoussainov
Alexander Melnikov
Frances Rosamond

Computability and Complexity

Essays Dedicated to Rodney G. Downey on the
Occasion of His 60th Birthday

Day, A.; Fellows, M.; Greenberg, N.; Khoussainov, B.;
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