INTEGERS 18A (2018)

INTRODUCTION: SPECIAL VOLUME IN HONOR OF JEFFREY SHALLIT ON THE OCCASION OF HIS 60TH BIRTHDAY

Narad Rampersad
Department of Mathematics and Statistics, University of Winnipeg, Winnipeg, Canada
n.rampersad@uwinnipeg.ca

Preface (by J.-P. Allouche, CNRS, IMJ-PRG): *Narad Rampersad and I are very happy that this special issue of* Integers *is dedicated to Jeffrey Shallit on the occasion of his 60th birthday. We would like to heartily thank all the authors who proposed an article, including those whose papers are not in the issue because their revised contribution did not arrive on time. We thank all the referees. We also would like to thank Bruce Landman very much: his hard work almost succeeded in compensating our relative slowness in contacting all people involved in this issue.*

Jeffrey Shallit was born in Philadelphia, Pennsylvania in 1957. He earned a Bachelor's degree in mathematics from Princeton University in 1979, followed by a Ph.D. in mathematics from the University of California, Berkeley in 1983. His advisors were David Goldschmidt (de jure) and Manuel Blum (de facto), and his doctoral thesis was on the "Metric Theory of Pierce Expansions". He is currently a Professor in the School of Computer Science at the University of Waterloo. He is also the Editor-in-chief of the *Journal of Integer Sequences* and was named an ACM Distinguished Scientist in 2008.

According to MathSciNet, Jeffrey Shallit has 210 publications with 147 co-authors and has been cited in 1610 publications. He has Erdős number 1, due to his paper, "New bounds on the length of finite Pierce and Engel series" (1991) with Paul Erdős [7]. He is the author of four books: *Neverending Fractions* (with Jon Borwein, Wadim Zudilin, and Alf van der Poorten) (2014) [6], *A Second Course in Formal Languages and Automata Theory* (2008) [8], *Automatic Sequences. Theory, Applications, Generalizations* (with Jean–Paul Allouche) (2003) [1], and *Algorithmic Number Theory* (with Eric Bach) (1996) [5].

Jeff's research interests are primarily in the areas of number theory, combinatorics on words, and automata theory. He is especially known for his work on the theory of automatic sequences, which involves aspects of each of these three areas. Automatic sequences are sequences that are computed by finite automata in the following way: given an integer base $k \geq 2$, the automaton computes the n-th term of the sequence by reading the base-k representation of n as input; the output is determined by the state reached at the end of the computation. The Thue-Morse sequence is the most well-known automatic sequence: Jeff has written an extensive survey with Allouche on this sequence, called "The ubiquitous Prouhet-Thue-Morse sequence" (1998) [3]. Jeff's book with Allouche mentioned previously is considered the standard reference

on the theory of automatic sequences. Jeff Shallit and Jean-Paul Allouche also introduced an important generalization of k-automatic sequences by defining the k-regular sequences. They presented this definition in their paper "The ring of k-regular sequences" (1992) [2]. This led to a deep theory concerning such sequences, with important connections to number theory.

In more recent years, Jeff has been the leading contributor to the use of computer-proof techniques to obtain results in combinatorics on words and number theory. This approach is based on ideas of Büchi and Bruyère, which show the decidability of a certain extension of Presburger arithmetic, which allows one to formulate and verify many properties of automatic sequences. This method was introduced in the paper "Periodicity, repetitions, and orbits of an automatic sequence" (2009) [4]. Jeff has since applied this method to give computer-based proofs of a large number of results. He supervised the development of the software program Walnut by his student Hamoon Mousavi, which implements this method and is freely available to the research community.

Jeff has supervised five Ph.D. students: Ming-wei Wang (2004), Narad Rampersad (2007), Dalia Krieger (2008), Troy Vasiga (2008), and Zhi Xu (2009).

References

[1] J.–P. Allouche and J. Shallit, *Automatic Sequences: Theory, Applications, Generalizations*, Cambridge University Press, 2003.

[2] J.–P. Allouche and J. Shallit, The ring of k-regular sequences, Theoret. Comput. Sci. 98 (1992), 163–197.

[3] J.–P. Allouche and J. Shallit, The ubiquitous Prouhet-Thue-Morse sequence. In Sequences and Their Applications (Singapore, 1998), pp. 1–16, Springer Ser. Discrete Math. Theor. Comput. Sci., 1999.

[4] J.–P. Allouche, N. Rampersad, and J. Shallit, Periodicity, repetitions, and orbits of an automatic sequence, Theoret. Comput. Sci. 410 (2009), 2795–2803.

[5] E. Bach and J. Shallit, *Algorithmic Number Theory. Vol. 1: Efficient Algorithms*, MIT Press, Cambridge, MA, 1996.

[6] J. Borwein, A. van der Poorten, J. Shallit, and W. Zudilin, *Neverending Fractions*, Cambridge University Press, 2014.

[7] P. Erdős and J. Shallit, New bounds on the length of finite Pierce and Engel series, Sém. Théor. Nombres Bordeaux 3 (1991), 43–53.

[8] J. Shallit, *A Second Course in Formal Languages and Automata Theory*, Cambridge University Press, 2008.