SPECIAL ISSUE

WORDS 2011

PREFACE

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The biannual series of WORDS meetings was inaugurated in 1997 and since then it became the main event in combinatorics on words. The 8th international conference WORDS 2011 was held in Prague, Czech Republic, September 12–16, 2011 and was attended by nearly 80 participants from 13 countries. Contributions presented at the conference were published in conference proceedings (as volume 63 of the Electronic Proceedings in Theoretical Computer Science). This special issue contains extended versions of 9 papers preselected by the program committee and subjected to standard reviewing process of IJFCS.

Combinatorics on words is a research area with a rich prehistory and various relations to other fields. It was introduced to the Mathematics Subject Classification in 1991 as a subfield of Discrete mathematics in relation to computer science, and since then witnessed more than two thousand publications, half of them as the primary subject. It can be observed that its share within the field is slightly growing in the long term.

One of the most prominent topics of combinatorics on words is pattern avoidance and, more specifically, repetitions in finite and infinite words. With the recent confirmation of over 30 years resistant Dejean's conjecture about the threshold between avoidable and unavoidable powers of words, many new challenging problems arose.

One of such questions, the growth rate of languages T_k of all threshold words, is approached in this volume by I. A. Gorbunova and A. M. Shur. It is conjectured that the growth rate of T_k tends to a limit as k tends to infinity. The authors prove that this true for a related family of languages, namely the languages $T_k^{(3)}$, which is the superset of T_k consisting of words avoiding forbidden repetitions where the excess of the repetition has length at most 3.

Repetition-free words are also subject of the article by E. A. Petrova and A. M. Shur. The authors focus on binary cube-free words that cannot be infinitely extended preserving cube-freeness. They show that such words exist but can have arbitrarily long finite cube-free extensions both to one side and two sides.

The bound on repetitions in a given infinite word is captured by the notion of critical exponent. It has been proven that if an infinite sequence is given as a fixed point of a uniform morphism, then its critical exponent is either infinite or a rational number. In their contribution in this volume, L. Shaeffer and J. Shallit generalize this result to automatic sequences, and show that the value of the critical exponent is computable.

Study of the critical exponent has some interesting and unexpected applications even outside theoretical computer science. One of such possibilities is the description of the physical properties (such as electron conductivity) of quasicrystals, whose 1982's discovery by Schechtman was recently awarded the Nobel prize. Due to their aperiodicity, one cannot use ordinary integers as coordinates for the atomic positions in these materials; instead, it turns useful to consider numbers with integer expansion in an irrational base system.

D. Dombek in his paper focuses on integers in systems with negative real bases $-\beta < -1$. Such numbers form a discrete set which can be coded by an infinite word, in general, over an infinite alphabet $\mathcal{A}$. The author shows that this infinite word is fixed by an antimorphism over $\mathcal{A}$.

One possible generalization of repetition avoidance consists in considering patterns with involutions and antimorphisms, partly motivated by the Watson-Crick complementarity of DNA strings. In their paper, S. Bischoff, J. Currie and D. Nowotka study unary patterns with involution and fully classify the alphabets for which such patterns are avoidable. It turns out that unary patterns exhibit the same avoidance properties for both morphic and antimorphic involutions.

Another emerging research area is the study of infinite permutations. The contribution of S. Widmer focuses on permutation complexity of words which are images of uniformly recurrent aperiodic binary words under the letter doubling map and provides an upper bound. A formula for the permutation complexity is proven for images of Sturmian words and the Thue-Morse word.

Codes are a classical topic of combinatorics on words. F. Burderi considers in his paper codes that are not uniquely decipherable and extends some classical results concerning uniquely decipherable codes, above all the notion of maximality, to this more general setting.

Last two papers in the present volume are related to formal languages. M. Cadilhac, A. Finkel and P. McKenzie study bounded languages recognized by Parikh automata. They show that in this framework it does not matter whether automata are deterministic or nondeterministic. Moreover, the class of bounded languages accepted by Parikh automata coincides with languages whose iteration set is semilinear.

The research of S. Crespi Reghizzi and P. San Pietro is motivated by a classical correspondence between a regular language and certain local language over a bigger alphabet the size of which depends on the size of the accepting finite automaton. Authors consider more general class of k -strictly locally testable languages, where k denotes the width of the testing window. They obtain a trade-off result concerning the alphabet size and the parameter k .

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