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Preface of STACS 2021 Special Issue

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This special issue contains 7 articles which are based on extended abstracts presented at the 38th *Symposium on Theoretical Aspects of Computer Science* (STACS). The conference was held online, due to Covid pandemic, organised in Saarbrücken by Saarland University from March 16 to March 19, 2021. The extended abstracts were chosen among the top papers of those which were selected for presentation in a highly competitive peer-review process (after which only 56 papers out of 228 submissions were accepted, putting STACS among the most competitive conferences in Theoretical Computer Science).

Compared with the original conference papers, the articles have been extended with a description of the context, full proofs, and additional results. They underwent a rigorous reviewing process, following the TOCS journal standards, completely independent from the selection process of STACS 2021.

The topics of the chosen papers cover various areas of Theoretical Computer Science, that is, algorithmic graph theory, linear dynamical systems, parameterized complexity analysis, automata theory, complexity theory, algorithmic group theory, and distributed algorithms. In what follows, we briefly describe the contributions of the papers, ordered alphabetically by author names.

In the article *"The Complexity of the Distributed Constraint Satisfaction Problem"*, Silvia Butti and Víctor Dalmau study the distributed variant of the constraint satisfaction problem on a synchronous, anonymous network from a complexity point of view. They show that the problem is decidable in polynomial time if and only if the template is a set of relations invariant under symmetric polymorphisms of all arities.

The Minimum Circuit Size Problem MCSP w.r.t. to some size bound s is the problem of deciding whether the minimum circuit size of a given Boolean function on n inputs is at most $s(n)$. Recent works in meta-complexity exhibited "hardness magnifi-

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cation" phenomena for MCSP: Very weak lower bounds for MCSP imply breakthrough result in complexity theory like P$\neq$NP. In their paper *"One-Tape Turing Machine and Branching Program Lower Bounds for MCSP"*, Mahdi Cheraghchi, Shuichi Hirahara, Dimitrios Myrisiotis, and Yuichi Yoshida prove new lower bounds against one-tape Turing machines and branching programs, which are the first non-trivial lower bounds for MCSP (and MKTP) against one-tape Turing machines as well as non-deterministic branching programs. These bounds essentially match the best-known lower bounds for any explicit function against these computational models.

In the article *"Reachability in two-parametric timed automata with one parameter is EXPSPACE-complete"*, Stefan Göller and Mathieu Hilaire study reachability in timed automata where clocks can be compared against parameters. Whereas the problem was known to be undecidable for three clocks and decidable in $\mathrm{PSPACE}^{\mathrm{NEXP}}$ for two clocks and one parameter, they show the latter is indeed an EXPSPACE-complete problem, thus refining both the lower bound by using deep results of complexity theory, and the upper bound via a reduction to parametric one-counter automata with one parameter that they study independently.

A k-digraph coloring of a given digraph is a partition of its vertices into at most k sets such that each set induces a DAG. This problem is known to be NP-hard, since it is a generalization of the well-known (undirected) k-Coloring-Problem. On the other hand, the problem becomes trivial if the input digraph is already acyclic. In their paper *"Digraph Coloring and Distance to Acyclicity"*, Ararat Harutyunyan, Michael Lampis, and Nikolaos Melissinos study this question in the parameterized setting using parameters that measure the distance of the input to acyclicity.

In their paper "Good r-Divisions Imply Optimal Amortized Decremental Biconnectivity", Jakob Holm and Eva Rotenberg present a data structure that, given a graph G of n vertices and m edges, and a suitable pair of nested r-divisions of G, preprocesses G in linear time and handles any series of edge-deletions in $O(m)$ total time while answering queries to pairwise biconnectivity in worst-case constant time. As an immediate consequence, this gives optimal amortized decremental biconnectivity, 2-edge connectivity, and connectivity for planar graphs and other minor free graphs.

Lars Jaffke, Paloma Lima, and Daniel Lokshtanov design a polynomial-time algorithm for the task of computing b-colorings on graphs of constant clique-width in their paper *"b-Coloring Parameterized by Clique-Width"*. This algorithms unifies all previously known polynomial time results on graph classes. In particular, with their new algorithm, the authors provide an answer to open questions posed by Campos and Silva as well as Bonomo et al.

In the article *"Subgroup Membership in* GL(2, $\mathbb{Z}$)*"*, Markus Lohrey shows that the subgroup membership problem for any virtually free group can be decided in polynomial time when all group elements are represented by power words of the form $p_1^{z_1} p_2^{z_2} \cdots p_n^{z_n}$, with z_i integers encoded in binary. It follows that the subgroup membership problem in GL(2, $\mathbb{Z}$) can be decided in polynomial time when the coefficients of matrices are encoded in binary.

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