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Preface of STACS 2019 Special Issue

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This special issue contains five articles which are based on extended abstracts presented at the 35th *Symposium on Theoretical Aspects of Computer Science* (STACS). The conference was held at the Technical University of Berlin from March 13 to March 16, 2019. 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 54 papers out of 260 submissions were accepted, putting it 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 2019.

The topics of the chosen papers cover various areas of Theoretical Computer Science, that is, algorithmic graph theory, automata theory, linear dynamical systems, parameterized complexity analysis, and distributed algorithms.

In what follows, we briefly describe the contributions of the papers, ordered alphabetically by author names.

Significantly extending the results of the conference version, the article *"First-Order Orbit Queries"* by Shaull Almagor, Joel Quaknine, and James Worrell studies fundamental reachability questions, so-called orbit problems: Here, for example, we are given a square matrix A of dimension d over the rationals and two semialgebraic

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sets S and T over the d-dimensional space of real numbers, and it is asked whether or not there exists a natural number n and an $x \in S$ such that $A^n x \in T$. Presenting a unified formalism for orbit problems, the authors prove that this formalism is decidable if $d \leq 3$. With their work, building on several deep mathematical methods, the authors generalize previous results. The studied problems are important for applications such as linear dynamical systems and program analysis.

In the Independent Set Reconfiguration problem under token sliding, we are given two independent sets S and T of a graph, and the goal is to determine whether S can be transformed into T by a sequence of token slides, i.e., by exchanging a vertex in the current set with one of its neighbors, while maintaining independence. The token sliding problem is one of the most well-studied problems in the area of combinatorial reconfiguration. In their work *"Token Sliding on Spilt Graphs"*, the authors Rémy Belmonte, Eun Jung Kim, Michael Lampis, Valia Mitsou, Yota Otachi, and Florian Sikora settle an open question by showing that the problem is PSPACE-complete on split graphs (and hence on chordal graphs), a question that has remained unanswered for a few years. In addition, they study coloring questions under the reconfiguration paradigm, providing further complexity classification results.

In their paper *"Space Lower Bounds for the Signal Detection Problem"*, Faith Ellen, Rati Gelashvili, Philipp Woelfel, and Leqi Zhu address a basic communication problem. More specifically, in the Signal Detection problem, n readers and a single signaler communicate by repeatedly accessing a shared memory. Their common goal is to allow each reader to decide, after each of its accesses to the memory, whether the signaler has accessed the memory since this reader's last access. A trivial solution to the problem is by having a flag (a single bit) for each reader in the shared memory. This requires n bits, which gives 2^n memory states. The main question addressed in the paper is whether there is an algorithm for solving the problem with less than 2^n memory states. The authors present lower bounds for restricted cases of the problem, as well as algorithms for some cases, which in turn rule out some directions for proving lower bounds.

The results presented by Antoine Mottet and Karin Quaas in the paper *"The Containment Problem for Unambiguous Register Automata and Unambiguous Timed Automata"* are motivated by problems in formal verification and database theory. Indeed, the Containment problem formalizes by means of register automata the question of whether a program complies with a given specification. Here, given two register automata $\mathcal{A}$ and $\mathcal{B}$, the question is whether the language accepted by $\mathcal{A}$ is a subset of the language accepted by $\mathcal{B}$. However, the Containment problem on non-deterministic register automata is known to be undecidable and known restrictions leading to decidability are too severe or considered as practically intractable. The contribution of the paper is to provide complexity and algorithmic results on the Containment problem when $\mathcal{B}$ is an unambiguous register automata.

In automata theory, a standard challenge is to generalize word automata results to tree automata. The contribution of Erik Paul in *"Finite Sequentiality of Unambiguous Max-Plus Tree Automata"* is such a result. The Sequentiality problem is to decide whether for an arbitrary max-plus automata there exists a deterministic equivalent. The variant of this problem, namely the finite sequentiality problem, was recently shown to be decidable on unambiguous max-plus automata. The main contribution of Erik Paul is to extend this latter result to unambiguous max-plus tree automata. The proof follows the scheme of the original proof for word automata but requires highly non-trivial adaptations. Compared to the extended abstract published in the proceedings of STACS 2019, the paper contains additional related properties that may lead to further generalizations.

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