Introduction to the Special Issue on SODA 2017

We are delighted to present a Special Issue of *ACM Transactions on Algorithms*, containing full versions of seven papers that were presented at the 28th Annual ACM-SIAM Symposium on Discrete Algorithms (SODA 2017) in Barcelona, Spain, on January 16–19, 2017. These papers, selected on the basis of their high rating by the conference program committee, have been thoroughly reviewed according to the journal's highest standards.

In "A $(2+\varepsilon)$-Approximation for Maximum Weight Matching in the Semi-Streaming Model," Ami Paz and Gregory Schwartzman study the maximum weight matching problem in graphs where the edges appear one by one, and after seeing an edge, the algorithm needs to decide, using small space and time, how to update the current approximate matching. The main result is that for every constant $\varepsilon > 0$ using only $O(n \log^2 n)$ space, one can maintain a $(2+\varepsilon)$-approximation to the maximum weight matching in the current graph by spending only $O(\log n)$ time per edge, improving vastly over the previous known $3.5+\varepsilon$-approximation in this setting.

In "Beating Approximation Factor Two for Weighted Tree Augmentation with Bounded Costs," David Adjiashvili gives the first polynomial-time algorithm with approximation ratio better than two for a classic graph-augmentation problem: given a spanning tree in an edge-weighted graph, augment the tree with a minimum-weight subset of edges to achieve 2-edge connectivity.

In "Firefighting on Trees Beyond Integrality Gaps," David Adjiashvili, Andrea Baggio, and Rico Zenklusen give the first polynomial-time approximation scheme (PTAS) for the Firefighter problem (introduced in 1995 by Hartnell) on trees, and the first polynomial-time constant-approximation algorithm for the related problem of Resource Minimization for Fire Containment (RMFC) on trees, matching the known hardness results.

In "Subquadratic Algorithms for the Diameter and the Sum of Pairwise Distances in Planar Graphs," Sergio Cabello presents the first algorithm for the diameter problem in planar graphs that runs in time that is truly subquadratic in the number of vertices, resolving a longstanding open problem. The diameter problem asks for the largest shortest paths distance in a graph. A truly subquadratic time algorithm for diameter in general graphs is known to have strong implications in complexity.

In "Even Delta-Matroids and the Complexity of Planar Boolean CSPs," Alexandr Kazda, Vladimir Kolmogorov, and Michal Rolínek study Boolean Constraint Satisfaction Problems (CSPs) under the restriction that every variable appears in at most two constraints. The main result is new tractable class of such CSPs: if all constraints are even Δ-matroids, then the problem is solvable in polynomial time. As a consequence, this result completes the dichotomy for planar Boolean CSPs.

In "Completeness for First-Order Properties on Sparse Structures with Algorithmic Applications," Jiawei Gao, Russell Impagliazzo, Antonina Kolokolova, and Ryan Williams relate the computational complexity of first-order model checking to the complexity of various variants of the orthogonal vectors problem. They show that a polynomially faster algorithm for Orthogonal Vectors would not only break the Strong Exponential Time Hypothesis but would also yield faster algorithms for a very large number of graph problems and many more problems.

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In "Polynomial Kernels and Wideness Properties of Nowhere Dense Graph Classes," Stephan Kreutzer, Roman Rabinovich, and Sebastian Siebertz provide improved bounds on the wideness of nowhere dense graph classes, which have been used previously to design parameterized algorithms for e.g. the distance-r dominating set problem. They derive these better bounds by employing methods from stability theory and highlight a novel and highly interesting connection between the fields.

The editors would like to thank the authors and the reviewers for their contributions in bringing this special issue out on time.

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