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Guest Editorial: Special Issue on Theoretical Informatics

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This special issue contains extended versions of a selection of papers from the 14th Latin American Symposium on Theoretical Informatics (LATIN 2020), held online in January 2021. The conference was born in 1992, when a group of Latin American researchers, under the leadership of Imre Simon (São Paulo, Brazil), launched the first of a series of symposia in theoretical computer science, to be held periodically in Latin America. LATIN is devoted to several areas of theoretical computer science including, but not limited to, algorithms (approximation, online, combinatorial optimization, etc.), algorithmic game theory, analytic combinatorics and analysis of algorithms, automata theory and formal languages, combinatorics and graph theory, computational algebra and number theory, computational complexity, computational biology, computational geometry, data structures and information retrieval, foundations of data science and theoretical machine learning, parallel and distributed computing, quantum computing, randomization and pseudorandomness, sublinear algorithms and testing. Among the papers presented in LATIN 2020, we selected for this issue ten papers that stood out, and we invited the authors to submit full versions of their work to this special issue. Their full papers went through a fresh, rigorous refereeing process. In the following, we briefly outline each of the papers.

In *A 2-approximation for the k-Prize-Collecting Steiner Tree Problem*, the authors present a 2-approximation algorithm for the k-Prize-Collecting Steiner Tree Problem, a network design problem that generalizes other known problems, such as the Prize-Collecting Steiner Tree Problem and the k-Minimum Spanning Tree Problem. Their

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result improves the previous best known approximation factor of 3.96, with a better running time.

The paper *On the maximum number of edges in chordal graphs of bounded degree and matching number*, the authors investigate the maximum number of edges that a chordal graph can have if its maximum degree and matching number are bounded. To this aim, they identify certain edge-extremal chordal graphs that have a particularly simple structure: those that are disjoint unions of cliques and stars.

In the paper *Improved upper bounds on the growth constants of polyominoes and polycubes*, the authors investigate the number of d-dimensional polycubes with n cubes and obtain upper bounds for their growth value. These bounds already improve previous results for $d = 2$ and $d = 3$.

In *Computing balanced convex partitions of lines*, the author investigates the problem of computing a ham-sandwich cut for an arrangement of lines in the plane, and its generalization to balanced convex partitions of lines in the plane. The author proves that these and other related problems can be solved in polynomial time.

The authors of the paper *Algorithms for p-faulty search on a half line* investigate a probabilistic variant of the cow-path optimization problem where a unit speed robot searches the half-line (or 1-ray) for a hidden item. The authors prove that a conjecture made for a variant of the problem, namely, the one in which the search is on a line (2-rays), that an optimal trajectory must be monotone, is not valid for the 1-ray variant. The authors also provide a lower bound for all monotone algorithms, which they also match with an upper bound.

In the paper *Monotone circuit lower bounds from robust sunflowers*, the authors present an $\exp(n^{1/2-o(1)})$ lower bound for the monotone circuit size of an explicit n-variate monotone function, improving the previous lower bound of $\exp(n^{1/3-o(1)})$. They also introduce a notion of robust clique-sunflowers to prove an $n^{\Omega(k)}$ lower bound on the monotone circuit size of the CLIQUE function for all $k \leq n^{1/3-o(1)}$. The preliminary version of this work was awarded the *Alejandro López-Ortiz Award* as the best paper of LATIN 2020.

In *Approximation algorithms for cost-robust discrete minimization problems based on their LP-relaxations*, the author investigates robust discrete minimization problems where the uncertainty is assumed to be in the objective. It is assumed that the objective function is not explicitly given, but is known to belong to a convex uncertainty set. Assuming the existence of an integrality gap verifier with a bounded approximation guarantee for the LP relaxation of the non-robust version of the problem, the author derives approximation algorithms for the robust version under different types of uncertainty, including polyhedral and ellipsoidal uncertainty.

In *Exponential-time quantum algorithms for graph coloring problems*, the authors present an exponential-space quantum algorithm computing the chromatic number of an n-vertex graph with running time $O(1.9140^n)$ using quantum random access memory (QRAM). The authors also present polynomial-space quantum algorithms with running time $O(1.9575^n)$ for the k-coloring problem, for $k \leq 20$, without using the QRAM, as well as $(4-\varepsilon)^n$-time classical algorithms that can be improved quadratically by Grover's search to obtain polynomial-space quantum algorithms.

In *Distinct fringe subtrees in random trees*, the authors investigate the problem of estimating the number of fringe subtrees (subtrees induced by one of the vertices and

all its descendants) in random trees. They prove that the order of magnitude of the number of distinct fringe subtrees (under rather mild assumptions) in random trees with n vertices is $n/\sqrt{\log n}$ for simply generated trees, and $n/\log n$ for certain families of increasing trees.

In *Transmitting once to elect a leader on wireless networks*, the authors investigate the leader election problem presenting randomized algorithms that succeed with high probability. Their algorithms have almost optimal energy complexity, as each device is allowed to send a one-bit message only once and listen to the network during two time slots at most. They consider different models, depending on the transmission and reception abilities to detect collision of the participating devices.

We are very grateful to the authors for accepting our invitation, the anonymous referees for their insightful and thorough reports, and the former and current Editors-in-Chief of Algorithmica Ming-Yang Kao and Mohammad T. Hajiaghayi, for giving us the oportunity to edit this special issue.

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