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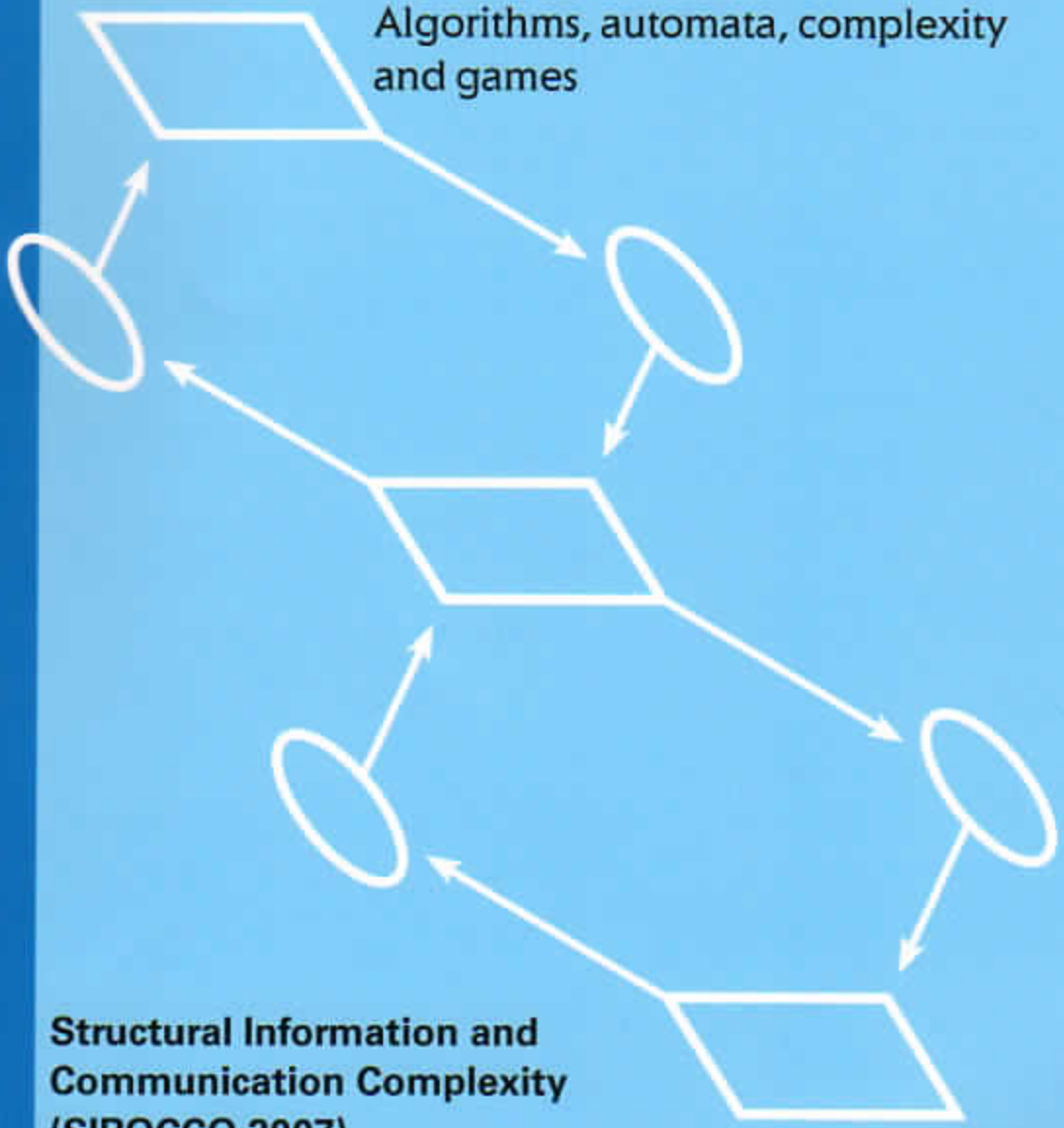
Theoretical Computer Science

Algorithms, automata, complexity and games



Structural Information and Communication Complexity (SIROCCO 2007)

Guest Editors: G. Prencipe S. Zaks

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Preface

This special issue of Theoretical Computer Science is dedicated to selected papers from the 14th Colloquium on Structural Information and Communication Complexity (SIROCCO) held in Castiglioncello (LI), Italy, June 5–8, 2007. The proceedings of this colloquium were published by Springer-Verlag as volume 4474 of the Lecture Notes in Computer Science (LNCS).

SIROCCO is an annual meeting focused on the relationship between computing and communication, i.e., the study of those factors that are significant for the computability and the communication complexity of problems and on the interplay between structure, knowledge and complexity. The colloquium provides an opportunity to bring together specialists interested in the fundamental principles underlying computing through communication.

SIROCCO prides itself on being a lively venue, which encourages the emergence of new research areas (related to distributed computing in a broad sense) and the dissemination of original ideas. This has been achieved by dedicating ample time for informal discussions and open problem sessions, in addition to regular conference activities.

The presentations in the 14th SIROCCO included 4 invited talks and 23 regular presentations selected by the program committee from 66 conference submissions. The 10 papers selected by the program committee for this special issue were accepted after a careful refereeing process, according to the normal TCS standards. This special issue provides a wide range of papers reflecting both the general scope of SIROCCO and the main themes exhibited in the conference presentations. Following, is a summary of the contributions of these papers.

- The paper by Nisse and Soguet studies the number of bits of advice (the number of bits of information that have to be available to nodes in order to accomplish a task) required to efficiently perform graph searching in a distributed setting. They show that the minimum number of bits of advice permitting the monotone connected and optimal clearing of a network in a distributed setting is $\theta(n \log n)$, where n is the number of nodes of the network.
- The paper by Broersma, Johnson, and Paulusma describes parallel knock-out schemes for graphs. These schemes proceed in rounds, in which each surviving vertex simultaneously eliminates one of its surviving neighbors, and a graph is reducible if such a scheme can eliminate all of its vertices. The paper resolves the square-root conjecture (MFCS 2004), by showing that, for a reducible graph G, the minimum number of required rounds is $O(\sqrt{n})$. Other results include upper bounds for specific families of graphs.
- The paper by Gafni, Mostéfaoui, Raynal, and Travers focuses on the relationship between the adaptive M-renaming problem (where the size of the name space depends only on the number of processors that participate in the renaming and not on the total number of processors), and the k-set agreement problems. They describe how a solution to the adaptive renaming problem can help in solving the k-set agreement problem when $t \geq k$, in an asynchronous system prone to up to t process crash failures.
- The paper by Manne, Mjelde, Pilard, and Tixeuil deals with the maximal matching problem. It presents a single self-stabilizing algorithm that unites all previous algorithms in the literature; that is, it has the same time complexity as the previous best algorithms for the sequential adversarial, the distributed fair, and the synchronous daemon. In addition, the algorithm improves the previous best time complexity for the distributed adversarial daemon.
- The paper by Korteweg, Marchetti-Spaccamela, Stougie, and Vitaletti studies data aggregation in sensor networks, where the main problem is to balance the communication and delay costs. This is presented as a bicriteria optimization problem: the objectives are to minimize maximum energy consumption of a sensor and a function of the maximum latency costs of a message. The problem is studied under a variety of time models, and competitive analysis is used to assess the quality of the algorithms.
- The paper by Efrima and Peleg studies systems of mobile autonomous robots: the partitioning problem is analyzed, where n robots must divide themselves into k size-balanced groups. In particular, deterministic crash fault tolerant algorithms are given for the problem in a few models, and a randomized algorithm is given for the semi-synchronous no-compass model. This is followed by results concerning the role of common orientation shared by the robots.

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- The paper by Even, Levi, and Litman studies comparator networks. A set of input vectors S is conclusive for a certain functionality if, for every comparator network, correct functionality for all input vectors is implied by correct functionality for all vectors in S. The paper considers four functionalities of comparator networks: sorting, merging, sorting of bitonic vectors, and halving. For each of these functionalities, the authors present tight bounds on the size of conclusive sets.
- The paper by Královič and Královič deals with the problem of broadcasting in synchronous point-to-point networks. The model of fractional dynamic faults with threshold is considered. As the main result, the authors show that, in complete graphs and hypercubes, it is possible to inform all but a constant number of vertices, exhibiting only a logarithmic slowdown. Moreover, they show that for complete graphs, under some additional conditions, the remaining constant number of vertices can be informed in the same time.
- The paper by Czyzowicz, Dobrev, Kranakis, Opatrny, and Urrutia is on providing a local deterministic algorithm for coloring the edges of *Yao-like* subgraphs of Unit Disk Graphs. The algorithm presented is local in the sense that each *node can receive information emanating only from nodes which are at most a constant number of hops away from it.* The number of colors used is optimal for local algorithms, showing that in this class of graphs the price for locality is only one additional color.
- Finally, the paper by Korman and Kutten deals with models for labeling schemes in graphs. In particular, a new generalized model is introduced, named *labeling schemes with queries*. In this model, one needs to consult the labels of three vertices, instead of two as in previous models. Moreover, as opposed to the strong technical skills that were needed to develop the traditional labeling schemes, most of the newly presented schemes are almost trivial and beat previous lower bounds.

We would like to thank all the authors and referees for their contribution to this special issue.

We would like to thank the *Università di Pisa*, the *Fondazione Cassa di Risparmi di Livorno*, and the *EU COST 293* action (GRAAL — Graphs and Algorithms in Communication Networks) for their generous support, that contributed to the success of the conference.

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