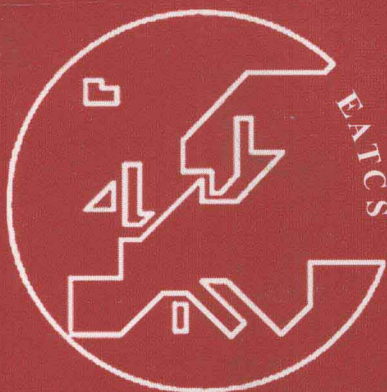


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Preface

This volume contains the 63 contributed papers and abstracts of invited talks presented at the 15th Annual European Symposium on Algorithms (ESA 2007), held in Eilat, Israel during October 8–10, 2007. The three distinguished invited speakers were Pierre Fraigniaud, Christos Papadimitriou and Micha Sharir.

Since 2002, ESA has consisted of two tracks, with Separate Program Committees, which deal with design and mathematical analysis of algorithms, the *Design and Analysis* track, and real-world applications, engineering, and experimental analysis of algorithms, the *Engineering and Applications* track. Previous ESAs in the current two-track format were held in Rome, Italy (2002); Budapest, Hungary (2003); Bergen, Norway (2004); Palma de Mallorca, Spain (2005); and Zurich, Switzerland (2006). The proceedings of these symposia were published as Springer's LNCS volumes 2461, 2832, 3221, 3669 and 4168, respectively.

Papers were solicited in all areas of algorithmic research, including Algorithmic Aspects of Networks, Approximation and On-line Algorithms, Computational Biology, Computational Finance and Algorithmic Game Theory, Computational Geometry, Data Structures, Databases and Information Retrieval, External-Memory Algorithms, Streaming Algorithms, Graph and Networks Algorithms, Graph Drawing, Machine Learning, Mobile and Distributed Computing, Pattern Matching and Data Compression, Quantum Computing, Randomized Algorithms, and Algorithm Libraries. The algorithms could be sequential, distributed or parallel. Submissions were especially encouraged in mathematical programming and operations research, including Combinatorial Optimization, Integer Programming, Polyhedral Combinatorics and Network Optimization.

Each extended abstract was submitted to one of the two tracks. The extended abstracts were read by three to four referees each, and evaluated on their quality, originality, and relevance to the symposium. The Program Committees of both tracks met at ETH Zurich during June 1–2, 2007. The Design and Analysis track selected 50 papers out of 165 submissions (one of the accepted papers was a merged version of two submitted papers). The Engineering and Applications track selected 13 out of 44 submissions.

ESA 2007 was sponsored by *EATCS* (the European Association for Theoretical Computer Science). We appreciate the critical financial support of the ALGO 2007 industrial sponsors *Checkpoint*, *Carmel Ventures*, and *Google*. The EATCS sponsorship included an award for the authors of the best paper “Online Primal-Dual Algorithms for Maximizing Ad-Auctions Revenue,” by Niv Buchbinder, Kamal Jain, and Joseph (Seffi) Naor, and the best student paper “Order Statistics in the Farey Sequences in Sublinear Time,” by Jakub Pawlewicz, as selected by the Program Committees.

July 2007

Lars Arge
Michael Hoffmann
Emo Welzl

Organization

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ESA 2007 was held along with the Fifth Workshop on Approximation and Online Algorithms (WAOA) in the context of the combined conference ALGO 2007. The Organizing Committee of ALGO 2007 consisted of (with special thanks to Nurit Shomrat-Aner):

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Nash Equilibria: Where We Stand

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Abstract. In the Fall of 2005 it was shown that finding an ϵ -approximate mixed Nash equilibrium in a normal-form game, even with two players, is PPAD-complete for small enough (additive) ϵ — and hence, presumably, an intractable problem. This solved a long-standing open problem in Algorithmic Game Theory, but created many open questions. For example, it is known that inverse polynomial ϵ is enough to make the problem intractable, while, for two player games, relatively simple polynomial algorithms are known to achieve ϵ near $\frac{1}{3}$; bridging this gap is an important open problem.

When the number of strategies per player is small, a different set of algorithmic techniques comes into play; it had been known, for example, that *symmetric* games of this sort can be solved in polynomial time, via a reduction to the existential theory of the reals. In on-going joint work with Costis Daskalakis we have shown that a simple exhaustive approach works in a broader, and more useful in practice, class of games known as *anonymous* games, in which the payoff of each player and strategy is a symmetric function of the strategies chosen by the other players; that is, a player's utility depends on *how many* other players have chosen each of the strategies, and not on *precisely which players* have. In fact, a variant of the same algorithmic technique gives a pseudopolynomial-time approximation scheme for general n -player games, as long as the number of strategies is kept a constant. Improving this to polynomial seems a challenging problem.

A third important front in this research project is exploring equilibrium concepts that are more attractive computationally than the mixed Nash equilibrium, and possibly more natural, yet no less universal (guaranteed to exist under quite general assumptions). A number of such alternatives have been explored recently, some of them in joint work with Alex Fabrikant. For example, we show that two-player games with random entries of the utility matrices are likely to have a natural generalization of a pure Nash equilibrium called *unit recall equilibrium*.

Finally, it had long been believed that Nash equilibria of *repeated games* are much easier to find, due to a cluster of results known in Game Theory as *the Folk Theorem*. We shall discuss how recent algorithmic insights cast doubt even to this reassuring fact.

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