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Preface

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Preface

This special issue of *Theoretical Informatics and Applications* arises from a workshop held in Barcelona, september 13 to 17, 1993, under the title "Probabilistic complexity classes and nonuniform computational models". It was organized by the Department Llenguatges i Sistemes Informàtics of the Universitat Politècnica de Catalunya. The context was a joint binational project, funded coordinatedly by the German DAAD and the Spanish "Acciones Integradas" of the Ministry of Education and Science. The project had the same title as the workshop, and was mainly developed at Barcelona and Ulm. This was the fourth workshop in that project, and was the first to be open to participation of all interested researchers in Complexity Theory.

The workshop actually gathered near 40 researchers from the USA, Canada, and various countries in Europe and the Middle East. An informal volume of proceedings, containing recent papers of the participants in the project, was gathered as a report of the organizing department (code LSI-93–24–R). Most of these results were announced in the technical presentations.

The subject of the workshop, while focusing on specific areas of Complexity Theory, was to be taken in a not too narrow fashion, aiming at some cross-influence between various areas. Specifically, the workshop had each session devoted to a guiding theme, each with a long overview talk and a number of shorter technical presentations. The themes included various approaches to probability and randomness in complexity classes, such as sparseness, selectiveness, or boundedness in the reduction, and some complexity-theoretic issues in Computational Learning and Neural Networks. Nonuniform complexity was found to provide a common intuition behind of most of them.

This issue, fully refereed according to the standards of the respectable professional journals, gathers final versions of some selected papers from the proceedings of that workshop. Several of them had been previously accepted, in conference form, for prestigious meetings like STACS or FST-TCS. In the process of making better journal versions, some of them have grown

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somewhat and acquired more authors; others have changed the title; all have improved substantially the contents, not only by the authors' work, but also thanks to the effort of the referees. The main research contributions, though, remain essentially the same.

The paper by Lozano shows how a general result can be proved that abstracts from several specific results by Kadin and others: from a collapse of a bounded-query hierarchy, a randomized reduction is obtained that collapses quantificational hierarchies. Castro and Seara consider classes defined over NP by reductions that ask only polylog many queries, and give tight characterizations of them thus solving problems left open in earlier papers. The concept of randomness proposed by Martin-Löf is generalized to the arithmetical hierarchy in the paper of Book and Mayordomo, and it is shown that these refinements of the notion behave with respect to resource-bounded reductions from the corresponding arithmetic class exactly as the Martin-Löf's notion does with respect to the recursively enumerable sets: in all cases, a characterization of a robust class ALMOST-R (where R is a reducibility) is obtained.

Thierauf, Toda and Watanabe push forward a result by Beigel, by obtaining deterministic subexponential time algorithms for NP under the hypothesis that tt-hard selective sets exist; Beigel's result obtained randomized polynomial time. Both results were later improved by other researchers, after publication of the conference version of this paper, down to deterministic polynomial time, with great technical effort; the present version describes also the relationship to these later results, since there are major technical differences. Finally, the paper by Arvind, Köbler and Mundhenk studies monotonic reductions to sparse sets, and provides additionally a valuable overview of previous research results about reductions to these sets, specifically those obtained by the "left set" proof method.

We believe that the work spent in preparing this issue will be welcomed by the specialist, and that the papers published here will be read and referenced in future works. It is my turn to thank the persons who helped me to make it possible: first and foremost, the authors, whose research is reported and who made extensive re-rewriting upon my request; then, the referees, for their very valuable an (in most cases) diligent job; and Christian Choffrut and Joaquim Gabarró, who reacted very positively to the initiative of composing this special issue.

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