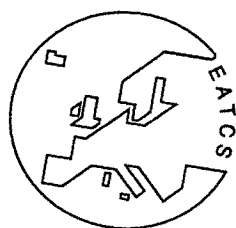


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M.S. Paterson (Ed.)



Automata, Languages and Programming

17th International Colloquium
Warwick University, England, July 16–20, 1990
Proceedings



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FOREWORD

ICALP stands for the International Colloquium on Automata, Languages and Programming and is sponsored by the European Association for Theoretical Computer Science (EATCS).

This annual conference series is intended to cover all important areas of theoretical computer science such as: computability, automata, formal languages, analysis of algorithms, computational complexity, data types and data structures, theory of data bases and knowledge bases, semantics of programming languages, program specification, transformation and verification, foundations of logic programming, theory of logical design and layout, parallel and distributed computation, theory of concurrency, symbolic and algebraic computation, term rewriting systems, computational geometry, cryptography, theory of robotics.

ICALP 90 has been organized by the University of Warwick, England, and is being held on the university campus from July 16 to July 20, 1990.

Previous colloquia were held in Stresa (1989), Tampere (1988), Karlsruhe (1987), Rennes (1986), Nafplion (1985), Antwerp (1984), Barcelona (1983), Aarhus (1982), Haifa (1981), Amsterdam (1980), Graz (1979), Udine (1978), Turku (1977), Edinburgh (1976), Saarbrücken (1974) and Paris (1972). ICALP 91 will be held in Madrid from July 8 to July 12, 1991.

The number of papers submitted was 250, representing an increase of 22% on the previous highest total. This made the task of selection exceptionally demanding and undoubtedly a large number of very good submissions were rejected. Each submitted paper was sent to four or five Programme Committee members, who were often assisted by other referees. The Programme Committee met for the final selection on 27th and 28th January 1990 at my home in Leamington Spa and at the University of Warwick. Those present at the meeting are indicated in the listing with an underline. Some of the absent members were prevented from attendance only at the last moment by illness and the extraordinary weather conditions at the time.

This volume contains the 52 selected papers together with the five papers from invited lecturers. For the convenience of delegates to the Colloquium, these are printed in order of presentation, grouped into more or less homogeneous sessions.

I thank all the Programme Committee for their willing cooperation in the unusually arduous task I set before them. My thanks go also to the small army of referees who assisted the Programme Committee in their work. The list of these overleaf is as complete as we can achieve, and I apologize for the inevitable omissions and errors.

The members of the Organizing Committee, our departmental secretaries, Josie Lloyd and Anne Warr, and several members of the department provided invaluable help throughout the preparations. The LaTeX style for many of the papers in this volume was supplied by Karel Culik II.

We gratefully acknowledge early and generous support from ICL (UK), the major sponsor of ICALP 90. Other substantial sponsorship was provided by ESPRIT Basic Research Actions, IBM (UK) and Springer-Verlag.

Mike Paterson

April 1990, University of Warwick

Invited lecturers

David Johnson (AT&T Bell Labs, USA)
 Neil D. Jones (U. Copenhagen, Denmark)
 Jan Willem Klop (CWI, Netherlands)
 Robin Milner (U. Edinburgh, UK)
 Kurt Mehlhorn (U. Saarland, FRG)

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