

Preface

The theory of traces has two independent origins: combinatorial problems arising from the rearrangements of strings and the theory of concurrent systems. The book by P. Cartier and D. Foata (*Problèmes Combinatoires de Commutation et Rearrangements*, Lecture Notes in Mathematics 85, Springer Verlag, Berlin, 1969) was concerned with the former, and the paper by A. Mazurkiewicz (*Concurrent program schemes and their interpretations*, DAIMI Report PB-78, Department of Computer Science, Aarhus University, Aarhus, Denmark, 1977) was motivated by the latter area. One should also mention in this context the paper by R. Keller (*Parallel Program Schemata and Maximal Parallelism I. Fundamental Results*, Journal of the Association of Computing Machinery 20, pp. 514-537, 1973) where an approach similar to that of Mazurkiewicz is applied in the investigation of parallel program schemes.

It was the paper by Mazurkiewicz that made the theory of traces so popular. The research community quickly recognized it as a major contribution to the theory of concurrent systems and to the theory of formal languages. Since then the theory of traces has become a very active research area – the bibliography included in this book contains 278 entries. By today the main lines of research in trace theory employ techniques and tackle problems from quite diverse areas which include formal language theory, combinatorics, graph theory, algebra, logic, and the theory of concurrent systems. In all these areas the theory of traces has led to interesting problems and significant results. It is the combination of the broad scope and the considerable depth that makes the theory of traces so exciting.

All important research lines of the theory of traces are covered by this monograph – each chapter of the book is devoted to one research line and is written by leading experts. It is organized in such a way that each chapter can be read independently, and so it is very suitable for advanced courses/seminars in areas such as formal language theory, theory of concurrent systems, and combinatorics and algebra.

We are indebted to the authors of individual chapters for their contributions.

This book is a result of cooperation between two ESPRIT projects, ASMICS II, Basic Research Working Group No. 6317 and CALIBAN, Basic Research Working Group No. 6067, which again underlines the broad scope of trace theory: ASMICS II is concerned with algebraic and language theoretic techniques in computer science, while CALIBAN is concerned with concurrent systems.

Our special thanks go to W. Ebinger, whose technical expertise in \TeX and devotion to all technical aspects of the production of this monograph were invaluable.

Finally we are indebted to Cartier, Foata and Mazurkiewicz for initiating the theory of traces, and to all the researchers in this area for making it so rich in interesting problems and beautiful results.

September 1994

V. Diekert, Stuttgart
G. Rozenberg, Leiden