Preface

This book presents state of the art research in theoretical computer science and related fields. In particular, the following areas are discussed: automata theory, formal languages and combinatorics of words, graph transformations, Petri nets, concurrency, as well as natural and molecular computing. The articles are written by leading researchers in these areas. The writers were originally invited to contribute to this book but then the normal refereeing procedure was applied as well. All of the articles deal with some issue that has been under vigorous study during recent years. Still, the topics range from very classical ones to issues raised only two or three years ago. Both survey articles and papers attacking specific research problems are included.

The book highlights some key issues of theoretical computer science, as they seem to us now at the beginning of the new millennium. Being a comprehensive overview of some of the most active current research in theoretical computer science, it should be of definite interest for all researchers in the areas covered. The topics range from basic decidability and the notion of information to graph grammars and graph transformations, and from trees and traces to aqueous algorithms, DNA encoding and self-assembly. Special effort has been given to lucid presentation. Therefore, the book should be of interest also for advanced students.

The feature common to all writers in this book is that they want to dedicate their work to *Grzegorz Rozenberg* on the occasion of his 60th birthday, March 14, 2002. In addition the topics belong to areas of his central interests, either currently or in the past. The broad spectrum of the topics is an indication of the width and diversity of the research of this great scientist. We have included in this book the bibliography of Grzegorz Rozenberg but we have not undertaken here the challenging task of describing or even outlining his scientific work. Instead, at the end of this Preface, each of the four editors presents his personal gratulatory greeting to Grzegorz. It is also very well known that Grzegorz Rozenberg occupies a central role in the theoretical computer science community in Europe. He was the President of EATCS for nine years and is still the Editor of the *EATCS Bulletin*, after being in this position already for more than twenty years. More about these matters can be read, for instance, in the book *People and Ideas in Theoretical Computer Science* (C. Calude, Ed.), Springer-Verlag, 1999, ISBN 981-4021-13-X, or in the *EATCS Bulletin* 46, 1992, 391–413.

The articles in this book are divided into five parts, according to their topics. A brief description of the individual parts now follows.

As its title *Words, Languages, Automata* indicates, the first part is concerned with the oldest issues in theoretical computer science. However, the papers reflect some currently active aspects of research. Classical context-free languages are considered in connection with the currently popular XML-documentation. Another old topic studies how simpler languages (for example regular languages)

can be used via trees to define more complicated ones (namely, context-free languages). Models of concurrency are discussed in two papers, using structural and logical approaches, respectively. The other four papers are connected to words. In two of those, old fundamental problems are addressed, namely, the celebrated Post Correspondence Problem and the commutation problem of Conway. Patterns occurring in infinite words is a challenging new topic. Finally, recent fundamental results on the structure of finite words are related to the notion of information.

Part two on graph transformations starts with a sightseeing tour of the computational landscape of this interesting field. The relationship between local action systems and algebraic graph grammars and bisimulation equivalences for graph grammars are discussed in two other contributions.

The concept of processes is addressed in part three on Petri nets from the high-level net point of view. Moreover, it is shown how Petri nets can be used as a control mechanism for grammar systems. Finally an interesting conjecture is presented relating regular event structures and finite Petri nets.

In addition to graph transformations and Petri nets, in part four, other models for concurrent computing are discussed. It is shown how object-oriented collaborative work can be supported by the concept of team automata. Other interesting topics are temporal concurrent constraint programming and how to use grammars as processes.

The final part deals with natural computing. Computation gleaned from nature is at its best in the article describing the amazing capabilities of ciliates. Studies about aqueous algorithms and self-assembly computations are also close to practical laboratory work. P systems have turned out to be a very useful model for natural computing. Some of the early aspects of DNA computing, namely splicing and DNA encoding, are addressed in two papers.

Munich, Berlin and   Wilfried Brauer, Hartmut Ehrig
Turku, December 2001   Juhani Karhumäki, Arto Salomaa