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## Preface

The theory of formal languages is widely accepted as the backbone of theoretical computer science. It mainly originated from mathematics (combinatorics, algebra, mathematical logic) and generative linguistics. Later, new specializations emerged from areas of either computer science (concurrent and distributed systems, computer graphics, artificial life), biology (plant development, molecular genetics), linguistics (parsing, text searching), or mathematics (cryptography). All human problem solving capabilities can be considered, in a certain sense, as a manipulation of symbols and structures composed by symbols, which is actually the stem of formal language theory. Language – in its two basic forms, natural and artificial – is a particular case of a symbol system.

This wide range of motivations and inspirations explains the diverse applicability of formal language theory  $\tilde{U}$  and all these together explain the very large number of monographs and collective volumes dealing with formal language theory.

In 2004 Springer-Verlag published the volume *Formal Languages and Applications*, edited by C. Martín-Vide, V. Mitrana and G. Păun in the series *Studies in Fuzziness and Soft Computing* 148, which was aimed at serving as an overall course-aid and self-study material especially for PhD students in formal language theory and applications. Actually, the volume emerged in such a context: it contains the core information from many of the lectures delivered to the students of the International PhD School in Formal Languages and Applications organized since 2002 by the Research Group on Mathematical Linguistics from Rovira i Virgili University, Tarragona, Spain.

During the editing process of the aforementioned volume, two situations appeared:

Some important aspects, mostly extensions and applications of classical formal language theory to different scientific areas, could not be covered, by different reasons. New courses were promoted in the next editions of the PhD School mentioned above.

To intend to fill up this gap, the volume *Recent Advances in Formal Languages and Applications*, edited by Z. Ésik, C. Martín-Vide and V. Mitrana, was published in 2006 by Springer-Verlag in the series *Studies in Computational Intelligence* 25.

The present volume is a continuation of this comprehensive publication effort. We believe that, besides accomplishing its main goal of complementing the previous volumes in representing a gate to formal language theory and its applications, it will be also useful as a general source of information in computation theory, both at the undergraduate and research level.

For the sake of uniformity, the introductory chapter of the first volume that presents the mathematical prerequisites as well as most common concepts and notations used throughout all chapters appears in the present volume as well. However, it may happen that terms other than those in the introductory chapter have different meanings in different chapters or different terms have the same meaning. In each chapter, the subject is treated relatively independent of the other chapters, even if several chapters are related. This way, the reader gets in touch with diverse points of view on an aspect common to two or more chapters. We are convinced of the usefulness of such an opportunity to a young researcher.

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