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Constraints in Computational Logics

Theory and Applications

International Summer School, CCL'99
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Revised Lectures

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Preface

CCL (*Construction of Computational Logics* and later *Constraints in Computational Logic*) is the name of an ESPRIT working group which met regularly from 1992 to 1999 (see `http://www.ps.uni-sb.de/ccl/`). It united research teams from Germany, France, Spain, and Israel, and was managed by the company COSYTEC.

In its final few years, the main emphasis of the working group was on *constraints* — techniques to solve them and combine them and applications ranging from industrial applications to logic programming and automated deduction. At the end of the working group, in fall 1999, we organized a summer school, intending to summarize the main advances achieved in the field during the previous 7 years. The present book contains the (revised) lecture notes of this school. It contains six chapters, each of which was written by some member(s) of the working group, covering the various aspects of constraints in computational logic. We intend it to be read by non specialists, though a prior knowledge in first-order logic and programming is probably necessary.

Constraints provide a declarative way of representing infinite sets of data. As we (attempt to) demonstrate in this book, they are well suited for the *combination* of different logical or programming paradigms. This is known since the 1980s for *constraint logic programming*, but has been combined with functional programming in more recent years; a chapter (by M. Rodríguez-Artalejo) is devoted to the combination of constraints, logic, and functional programming.

The use of constraints in automated deduction is more recent and has turned out to be very successful, moving the control from the meta-level to the constraints, which are now first-class objects. This allows us to keep a history of the reasons why deductions were possible, hence restricting further deductions. A chapter of this book (by H. Ganzinger and R. Nieuwenhuis) is devoted to constraints and theorem proving.

Constraints are not only a nice mathematical construction. The chapter (by H. Simonis) on industrial applications shows the important recent developments of constraint solving in real life applications, for instance scheduling, decision making, and optimization.

Combining constraints (or combining decision procedures) has emerged during the last few years as an important issue in theorem proving and verification. Constraints turn out to be an adequate formalism for combining efficient techniques on each particular domain, thus yielding algorithms for mixed domains. There is now a biannual workshop on these topics, of which the proceedings are published in the LNAI series. The chapter on Combining Constraints Solving (by F. Baader and K. Schulz) introduces the subject and surveys the results.

Before these four chapters on applications of constraint solving, the introductory chapter (by J.-P. Jouannaud and R. Treinen) provides a general introduction to constraint solving. The chapter on constraint solving on terms (by H. Comon and C. Kirchner) introduces the constraint solving techniques which are used in, e.g. applications to automated deduction.

Every chapter includes an important bibliography, to which the reader is referred for more information.

We wish to thank the reviewers of these notes, who helped us improve the quality of this volume. We also thank the European Union who supported this work for 6 years and made possible the meeting in Gif.

January 2001

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