Peter Vojtáš
Mária Bieliková
Bernadette Charron-Bost
Ondrej Sýkora (Eds.)

SOFSEM 2005: Theory and Practice of Computer Science

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31st Conference on Current Trends
in Theory and Practice of Computer Science
Liptovský Ján, Slovakia, January 2005, Proceedings

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Preface

This volume contains papers selected for presentation at the 31st Annual Conference on Current Trends in Theory and Practice of Informatics – SOFSEM 2005, held on January 22–28, 2005 in Liptovský Ján, Slovakia.

The series of SOFSEM conferences, organized alternately in the Czech Republic and Slovakia since 1974, has a well-established tradition. The SOFSEM conferences were originally intended to break the Iron Curtain in scientific exchange. After the velvet revolution SOFSEM changed to a regular broad-scope international conference. Nowadays, SOFSEM is focused each year on selected aspects of informatics. This year the conference was organized into four tracks, each of them complemented by two invited talks:

- *Foundations of Computer Science* (Track Chair: Bernadette Charron-Bost)
- *Modeling and Searching Data in the Web-Era* (Track Chair: Peter Vojtáš)
- *Software Engineering* (Track Chair: Mária Bieliková)
- *Graph Drawing* (Track Chair: Ondrej Sýkora)

The aim of SOFSEM 2005 was, as always, to promote cooperation among professionals from academia and industry working in various areas of informatics. Each track was complemented by two invited talks.

The SOFSEM 2005 Program Committee members coming from 13 countries evaluated 144 submissions (128 contributed papers and 16 student research forum papers). After a careful review process (counting at least 3 reviews per paper), followed by detailed discussions in the PC, and a co-chairs meeting held on October 8, 2005 in Bratislava, Slovakia, 44 papers (overall acceptance rate 34.38%) were selected for presentation at SOFSEM 2005: 28 full contributed papers (acceptance rate 21.88%) and 16 short contributed papers selected by the SOFSEM 2005 PC for publication in the Springer LNCS proceedings volume.

An integral part of SOFSEM is the Student Research Forum. The forum offers the opportunity to publish, present and discuss student projects, to receive feedback on both the original results of scientific work as well as on work in progress. The Program Committee selected 7 papers for publication (from 16 submitted) for presentation at the Student Research Forum session. The best student paper by Martin Senft was selected and included in these proceedings.

We would like to thank all Program Committee members for their meritorious work in evaluating the submitted papers, as well as numerous additional referees who assisted the Program Committee members.

As editors of these proceedings, we are much indebted to all the contributors to the scientific program of the symposium, especially to the authors of the papers. Special thanks go to those authors who prepared the manuscripts according to the instructions and made life easier for us. We would also like to thank those who responded promptly to our requests for minor modifications

and corrections in their manuscripts. The database and electronic support system for the Program Committee was designed by Rastislav Královič. Our special thanks go to Richard Královič for most of the hard technical work in preparing this volume. We are also thankful to the members of the Organizing Committee led by Dana Pardubská who made sure that the conference ran smoothly in a pleasant environment. Last, but not least, we want to thank Springer for excellent cooperation in the publication of this volume.

January, 2005

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Discovering Treewidth

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Abstract. Treewidth is a graph parameter with several interesting theoretical and practical applications. This survey reviews algorithmic results on determining the treewidth of a given graph, and finding a tree decomposition of small width. Both theoretical results, establishing the asymptotic computational complexity of the problem, as experimental work on heuristics (both for upper bounds as for lower bounds), preprocessing, exact algorithms, and postprocessing are discussed.

1 Introduction

About a quarter of a century, the notion of treewidth has now played a role in many investigations in algorithmic graph theory. While for a long time, the use of treewidth was limited to theoretical investigations, and it sometimes was believed that it could not play a role in practical applications, nowadays there is a growing tendency to use it in an actual applied setting.

An interesting example of this practical use of treewidth can be found in the work by Koster, van Hoesel, and Kolen [63], where tree decompositions are used to solve frequency assignment instances from the CALMA project, and other partial constraint satisfaction problems. The most frequent used algorithm to solve the inference problem for probabilistic, or Bayesian belief networks (often used in decision support systems) uses tree decompositions [67]. See e.g., also [1, 39].

Graphs of bounded treewidth appear in many different contexts. For an overview of graph theoretic notions that are equivalent to treewidth, or from which bounded treewidth can be derived, see [12]. Many probabilistic networks appear to have small treewidth in practice. Yamagucki, Aoki, and Mamitsuka [91] have computed the treewidth of 9712 chemical compounds from the LIGAND database, and discovered that all but one had treewidth at most three; the one exception had treewidth four. Thorup [86] showed that the control flow graph of goto-free programs, written in one of a number of common imperative programming languages (like C, Pascal) have treewidth bounded by small constants. See also [45].

Many problems can be solved in linear or polynomial time when the treewidth of the input graph is bounded. Usually, the first step of such an algorithm is to find a tree decomposition of small width. In this paper, we give an overview of

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