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Preface

This volume contains the articles that were presented at the 8th International Symposium on Foundations of Information and Knowledge Systems (FoIKS 2014), which was held in Bordeaux, France, March 3–7, 2014.

The FoIKS symposia provide a biennial forum for presenting and discussing theoretical and applied research on information and knowledge systems. The goal is to bring together researchers with an interest in this subject, share research experiences, promote collaboration, and identify new issues and directions for future research.

FoIKS 2014 solicited original contributions on foundational aspects of information and knowledge systems. This included submissions that apply ideas, theories, or methods from specific disciplines to information and knowledge systems. Examples of such disciplines are discrete mathematics, logic and algebra, model theory, information theory, complexity theory, algorithmics and computation, statistics, and optimization.

Previous FoIKS symposia were held in Kiel (Germany) in 2012, in Sofia (Bulgaria) in 2010, Pisa (Italy) in 2008, Budapest (Hungary) in 2006, Vienna (Austria) in 2004, Schloss Salzau near Kiel (Germany) in 2002, and Burg/Spreewald near Berlin (Germany) in 2000. FoIKS took up the tradition of the conference series Mathematical Fundamentals of Database Systems (MFDBS), which initiated East – West collaboration in the field of database theory. Former MFDBS conferences were held in Rostock (Germany) in 1991, Visegrad (Hungary) in 1989, and Dresden (Germany) in 1987.

The FoIKS symposia are a forum for intense discussions. Speakers are given sufficient time to present their ideas and results within the larger context of their research. Furthermore, participants are asked in advance to prepare a first response to a contribution of another author in order to initiate discussion.

Suggested topics for FoIKS 2014 included, but were not limited to:

- Database Design: formal models, dependencies and independencies
- Dynamics of Information: models of transactions, concurrency control, updates, consistency preservation, belief revision
- Information Fusion: heterogeneity, views, schema dominance, multiple source information merging, reasoning under inconsistency
- Integrity and Constraint Management: verification, validation, consistent query answering, information cleaning
- Intelligent Agents: multi-agent systems, autonomous agents, foundations of software agents, cooperative agents, formal models of interactions, logical models of emotions
- Knowledge Discovery and Information Retrieval: machine learning, data mining, formal concept analysis and association rules, text mining, information extraction

- Knowledge Representation, Reasoning and Planning: non-monotonic formalisms, probabilistic and non-probabilistic models of uncertainty, graphical models and independence, similarity-based reasoning, preference modeling and handling, argumentation systems
- Logics in Databases and AI: classical and non-classical logics, logic programming, description logic, spatial and temporal logics, probability logic, fuzzy logic
- Mathematical Foundations: discrete structures and algorithms, graphs, grammars, automata, abstract machines, finite model theory, information theory, coding theory, complexity theory, randomness
- Security in Information and Knowledge Systems: identity theft, privacy, trust, intrusion detection, access control, inference control, secure Web services, secure Semantic Web, risk management
- Semi-Structured Data and XML: data modeling, data processing, data compression, data exchange
- Social Computing: collective intelligence and self-organizing knowledge, collaborative filtering, computational social choice, Boolean games, coalition formation, reputation systems
- The Semantic Web and Knowledge Management: languages, ontologies, agents, adaptation, intelligent algorithms
- The WWW: models of Web databases, Web dynamics, Web services, Web transactions and negotiations

The call for papers resulted in the submission of 52 full articles. In a rigorous reviewing process, each submitted article was reviewed by at least three international experts. The 14 articles judged best by the Program Committee were accepted for long presentation. In addition, five articles were accepted for short presentation. This volume contains versions of these articles that were revised by their authors according to the comments provided in the reviews. After the conference, authors of a few selected articles were asked to prepare extended versions of their articles for publication in a special issue of the journal *Annals of Mathematics and Artificial Intelligence*.

We wish to thank all authors who submitted papers and all conference participants for fruitful discussions. We are grateful to Dov Gabbay, Cyril Gavoille, and Jeff Wijsen, who presented invited talks at the conference; this volume also contains articles for two of the three invited talks. We would like to thank the Program Committee members and additional reviewers for their timely expertise in carefully reviewing the submissions. We want to thank Markus Kirchberg for his work as publicity chair. The support of the conference provided by the European Association for Theoretical Computer Science (EATCS) and by CPU LABEX of the University of Bordeaux is greatfully acknowledged. Special thanks go to Sofian Maabout and his team for being our hosts and for the wonderful days in Bordeaux.

March 2014

Christoph Beierle
Carlo Meghini

Conference Organization

FoIKS 2014 was organized by the University of Bordeaux, France.

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Invited Talks

The Equational Approach to Contrary-to-duty Obligations

Dov M. Gabbay

Bar-Ilan University, Ramat-Gan, Israel
King's College London, London, UK
University of Luxembourg, Luxembourg

We apply the equational approach to logic to define numerical equational semantics and consequence relations for contrary to duty obligations, thus avoiding some of the traditional known paradoxes in this area. We also discuss the connection with abstract argumentation theory. Makinson and Torre's input output logic and Governatori and Rotolo's logic of violation.

Data Structures for Emergency Planing

Cyril Gavoille

LaBRI - University of Bordeaux, Bordeaux, France

We present in this talk different techniques for quickly answer graph problems where some of the nodes may be turn off. Typical graph problems are such as connectivity or distances between pair of nodes but not only. Emergency planing for such problems is achieved by pre-processing the graphs and by virtually preventing all possible subsequent node removals. To obtain efficient data structures, the idea is to attach very little and localized information to nodes of the input graph so that queries can be solved using solely on these information. Contexts and solutions for several problems will be surveyed.

A Survey of the Data Complexity of Consistent Query Answering under Key Constraints

Jef Wijsen

Université de Mons, Mons, Belgium

This talk adopts a very elementary representation of uncertainty. A relational database is called uncertain if it can violate primary key constraints. A repair of an uncertain database is obtained by selecting a maximal number of tuples without selecting two distinct tuples of the same relation that agree on their primary key. For any Boolean query q, $\mathsf{CERTAINTY}(q)$ is the problem that takes an uncertain database **db** on input, and asks whether q is true in every repair of **db**. The complexity of these problems has been particularly studied for q ranging over the class of Boolean conjunctive queries. A research challenge is to solve the following complexity classification task: given q, determine whether $\mathsf{CERTAINTY}(q)$ belongs to complexity classes **FO**, **P**, or **coNP**-complete.

The counting variant of $\mathsf{CERTAINTY}(q)$, denoted $\sharp\mathsf{CERTAINTY}(q)$, asks to determine the exact number of repairs that satisfy q. This problem is related to query answering in probabilistic databases.

This talk motivates the problems $\mathsf{CERTAINTY}(q)$ and $\sharp\mathsf{CERTAINTY}(q)$, surveys the progress made in the study of their complexity, and lists open problems. We also show a new result comparing complexity boundaries of both problems with one another.

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