Preface

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This special issue of the *Annals of Mathematics and Artificial Intelligence* contains thoroughly revised and significantly extended versions of selected papers presented at the *Seventh International Symposium on Foundations of Information and Knowledge Systems (FoIKS 2012)*, which was held in Kiel, Germany, March 5–9, 2012.

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 2012 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 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.

There were 20 articles at FoIKS 2012, which were selected out of 42 submitted papers in a rigorous reviewing process, where each submission was reviewed by at least three program committee members. After the conference, the authors of eight papers judged best were invited to prepare thoroughly revised and significantly extended versions of their conference

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contributions to be considered for inclusion into this special issue. Based on a rigorous reviewing process, all eight papers listed below have been selected.

- In *Achieving parametric uniformity for knowledge bases in a relational probabilistic conditional logic with maximum entropy semantics*, Christoph Beierle and Annika Krämer investigate the relational probabilistic conditional logic FO-PCL, whose semantics employs the principle of maximum entropy. If a set of rules $\mathcal{R}$ is parametrically uniform, their maximum entropy model can be computed on the level of the rules in $\mathcal{R}$ rather than on the level of instances of the rules in $\mathcal{R}$. They elaborate in detail the reasons that cause $\mathcal{R}$ to be not parametrically uniform, derive a new syntactic criterion for parametric uniformity, and develop an algorithm that transforms any FO-PCL knowledge base $\mathcal{R}$ into an equivalent knowledge base $\mathcal{R}'$ that is parametrically uniform.
- In *A dissimilarity-based framework for generating inconsistency-tolerant logics*, Ofer Arieli and Anna Zamansky show that inconsistency-tolerance can be achieved for any logic that is based on a denotational semantics. They trade distances for the more general notion of dissimilarities, examine the basic properties of the entailment relations that are obtained, and exemplify dissimilarity-based reasoning in various forms of denotational semantics, including multi-valued semantics, non-deterministic semantics, and possible-worlds (Kripke-style) semantics. Their approach can be viewed as an extension of several well-studied forms of reasoning in belief revision, database integration, consistent query answering, and inconsistency maintenance in knowledge-based systems.
- In *Preserving confidentiality while reacting on iterated queries and belief revisions*, Joachim Biskup and Cornelia Tadros explore systems of multiple agents that are interested in hiding confidential parts of their beliefs from another requesting agent, and thus control the respective reaction to a revision or query request. They define the confidentiality aims of the reacting agent and postulate the requesting agent's capabilities in attacking these interests. In particular, they study an operator (based on a class of nonmonotonic consequence relations) via which the requesting agent attempts to skeptically entail confidential beliefs of the reacting agent from observed reactions. They also give an algorithmic solution for the reacting agent to enforce her confidentiality aims.
- In *A model for learning the news in social networks*, Krishnan Rajagopalan, Venkatesh Srinivasan, and Alex Thomo explore how to remove timestamps (which have certain drawbacks) from learning the news about other people in social networks via meeting online from time to time and share information they know about themselves and the other users. They present an efficient method which removes the need to timestamp user information (news): Only the meetings of the groups have to be indexed, and this indexing can be performed using a finite set of labels so that each user stores at most $O(N^2 \log N)$ bits of information. They also show that this bound can be improved in some cases if one has further information on the topology of the network.
- In *Constructing Armstrong tables for general cardinality constraints and not-null constraints*, Sven Hartmann, Henning Köhler, Uwe Leck, Sebastian Link, Bernhard Thalheim, and Jing Wang study the implication problem of the combined class of general cardinality constraints and not-null constraints on partial bags. They investigate structural properties of Armstrong tables for general cardinality constraints and not-null constraints, and prove exact conditions for their existence. For the fragment of general max-cardinality constraints, unary min-cardinality constraints, and not-null constraints,

- they show that the effort for constructing Armstrong tables is precisely exponential, and they also provide an axiomatic characterization of the implication problem.
- In *The impact of transitive closure on the expressiveness of navigational query languages on unlabeled graphs*, George H. L. Fletcher, Marc Gyssens, Dirk Leinders, Jan Van den Bussche, Dirk Van Gucht, Stijn Vansummeren, and Yuqing Wu study the expressive power of navigational query languages on graphs. Their basic language has only the operators union and composition and the identity relation. For the languages considered, adding transitive closure augments the expressive power not only at the level of path queries, but under certain conditions also at the level of Boolean queries. This holds no longer for unlabeled graphs; they prove that this is indeed not the case for the basic language plus none, one, or both of projection and the diversity relation.
 - In *Functional dependencies on extended relations defined by regular languages*, Gyula I. Szabó and András Benczúr introduce extended tuples as sentences from a regular language, which are generated by a grammar whose nonterminal symbols are the tuple's attribute names. Sets of extended tuples are the extended relations. They then introduce the dual language, which generates the tuple types allowed in extended relations. They define functional dependencies over extended relations; their syntax is given on the graph of the finite state automaton accepting the regular language. They can also handle extended relations generated by recursive regular expressions. The implication problem of their class of dependencies is decidable and finitely axiomatizable.
 - In *Functional dependencies are helpful for partial materialization of data cubes*, Eve Garnaud, Sofian Maabout, and Mohamed Mosbah propose to characterize the parts of a data cube to be materialized with the help of the functional dependencies present in the underlying data. They consider two applications: (i) how to choose the best cuboids of a data cube to materialize in order to guarantee a fixed performance of query evaluation and, (ii) how to choose the best tuples, hence partial cuboids, in order to reduce the size of the data cube without losing information. In both cases, functional dependencies turn to be fundamental in characterizing the solutions of these problems.

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