Workshop
"Reasoning about Structured Objects: Knowledge Representation Meets Databases"

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Organized by
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Object-centered formalisms for domain modeling play an important role both in knowledge representation (KR) and in the database (DB) area. Nevertheless, there has been little cross-fertilization between the two areas. Research in databases was mostly concerned with handling large amounts of data that are represented in a rather inexpressive formalism, whereas KR concentrated on intensional inferences in relatively small knowledge bases. However, many of today's problems demand sophisticated reasoning on complex and large-scale objects. The workshop is intended to bring together researchers from both areas to continue the discussion about the problems and applications of a combination of KR and DB techniques, which was initiated at the predecessor workshop KRDB-94, and to identify new such questions and solutions.

For the following (non-exclusive) list of questions, such a combination seems to be most promising:

- KR formalisms as schema languages in DB: Is it possible to specify realistic DBs this way? Can the inference mechanisms from KR support the schema design?
- Distributed information sources: How can one describe their interaction in a changing environment?
- Advanced query processing: How can schema knowledge be utilized for query optimization? How can it be used to generate intensional answers?

The first session is devoted to *extensions of knowledge representation by database techniques*. Bresciani describes an architecture that combines a KR system based on description logic and a relational DBMS by so-called close coupling. The amalgamated system presents itself like a KR system. Some parts of the class taxonomy reside in a database, however. In order to comply with the semantics of the KR system, only a fragment of the possible queries are allowed for retrieving objects from the database part. James, Gatward, and Shipley present an extension of the very expressive KR language CPL (conceptual prototyping language) by a language for describing object-oriented schemas in order to combine the management and processing of routine data with the reflection and utilization of knowledge. Lebastard proposes to define an object-oriented DBMS on top of a relational DBMS. Thus the user can choose the object model to be handled and has access to arbitrary relational databases. Reimer, Lippuner, Norrie, and Rys describe a formal mapping of DL inferences to queries of the OODB system COCOON. This extends the mapping of concept descriptions to class descriptions presented at KRDB-94.

The topic of the second session is the *extension of databases by knowledge representation techniques*. Kessel, Rousselot, Schlick, and Stern intend to combine a description logic system and a DBMS, motivated by their applications in the areas CAD and document retrieval, in which the ability to manage huge amounts of data is crucial. Simonet and Simonet present the P-type data model and show that it is closely related to description logics. The goal of their work is to transfer reasoning techniques developed for description logics, like subsumption algorithms, to P-types. Calvanese, De Giacomo, and Lenzerini introduce a new and very expressive data model for describing classes, views and links. Reasoning in this model is based on techniques, developed by the authors, for reasoning in expressive description logics allowing for, e.g., number restrictions, inverse roles, and recursive definitions. Nissen and Zemanek describe the successful usage of the KR system ConceptBase for modeling business processes and for requirements engineering. The cooperation that resulted in this work was initiated at KRDB-94.

The third session is concerned with *Queries*. Bergamaschi, Sartori, and Vincini propose the use of reasoning techniques from KR (subsumption computation) for computing intensional answers to DB queries by taking integrity constraints and the DB schema into account. Savnik, Tari, and Mohorič proposes a language that allows to manipulate and reason about the schema of a database, and to express declarative queries. Schild investigates the use of expressive description logics as database query languages. He presents a language that allows one to formulate queries that are beyond the expressivity of relational query languages, but can still be efficiently evaluated. He achieves tractability for his expressive language by exchanging the "open world" assumption usually employed in description logics by the "closed world" assumption customary in the DB area.

The three papers of the last session investigate the KR and DB issues from the viewpoint of *interoperable systems*. Boudjlida observes that complex objects play a significant role in the engineering of interoperable systems. KR-based reasoning as well as reflexivity are proposed to aid development. Edmond, Papazoglou, Russell, and Tari package conventional database systems via complex objects to provide a more flexible access. Here, reflection is used to represent information about the databases to application systems. Kusch and Saake investigate methods for partitioning complex objects in a distributed information system environment, with the goal of preserving local autonomy. Partitioning is expressed in terms of a formal specification language.

We hope that the mixture of DB and KR experts participating in the workshop will trigger interesting discussions. Ideally, researchers from both areas can use the meeting as starting point for fruitful contacts and, possibly, cooperation between the two areas. An extended version of the proceedings of this workshop will appear as DFKI Report.