15 (1) 1991

Abstract. In the paper we consider properties of minimal sets of attributes (reducts) which determine an equivalence relation $ind(P)$. We show that the problem to figure out all reducts of a given set is NP-complete. Subsequently, we present some properties of the set of all attributes which are indispensable to create $ind(P)$.

Abstract. We investigate possible ways to extend the notion of determinacy from automata to general concurrent systems (described here mainly as behavior structures).

Abstract. Jungle evaluation is proposed as a new graph rewriting approach to the evaluation of functional expressions and, in particular, of algebraically specified operations. Jungles – being intuitively forests of coalesced trees with shared substructures – are certain acyclic hypergraphs (or equivalently, bipartite graphs) the nodes and edges of which are labeled with the sorts and operation symbols of a signature. Jungles are manipulated and evaluated by the application of jungle rewrite rules, which generalize equations or, more exactly, term rewrite rules. Indeed, jungle evaluation turns out to be a compromise between term rewriting and graph rewriting displaying some favorable properties: the inefficiency of term rewriting is partly avoided while the possibility of structural induction is maintained, and a good part of the existing graph grammar theory is applicable so that there is some hope that the rich theory of term rewriting is not lost forever without a substitute.

Abstract. One of the main results of the paper is a characterization of certain kind similarity relations in Pawlak knowledge representation systems by means of first order sentences. As an application we obtain a complete finite axiomatization of the corresponding poly modal logic, called in the paper MLSim. It is proved that MLSim possesses finite model property and is decidable.

Abstract. In a natural formulation, Craig's interpolation theorem is shown to hold for conditional equational logic.

ON PURE CONTEXT-FREE LANGUAGES AND LEFT SZILARD LANGUAGES

Erkki Makinen *86-89*

Abstract. It is shown that left Szilard languages of context-free grammars are pure context-free languages. This is one of the few exceptions among the numerous negative results concerning the generative capacity of pure languages. Moreover, we characterize pure context-free languages and left Szilard languages of pure context-free grammars as certain homomorphic images.

ON THE POWER OF TWO-DIMENSIONAL SYNCHRONIZED ALTERNATING FINITE AUTOMATA

Juraj Hromkovic, Katsushi Inoue, Akira Ito and Itsuo Takanami *90-98*

Abstract. It is well known that four-way two-dimensional alternating finite automata are more powerful than three-way two-dimensional alternating finite automata, which are more powerful than two-way two-dimensional alternating finite automata. This paper shows that four-way, three-way, and two-way two-dimensional "synchronized" alternating finite automata all have the same power as rectangular array bounded automata.

A PROBLEM ON EASY TERMS IN A-CALCULUS

Benedetto Intrigila *99-106*

Abstract. We say that a closed term M is easy in the $\alpha\beta\eta$- calculus if for every term N the theory $\alpha\beta\eta + \{M = N\}$ is consistent. The main result of the paper is to show that, for a certain term P, the term $P(\omega\omega)$ is easy, while $P\omega$ is not. It follows that the easiness of a given M does not imply either easiness or non-easiness of PM, contradicting an earlier conjecture.

15 (2) 1991

Abstract. In this paper the relationship between dependency theory and first-order logic is explored in order to show how relational chase procedures (i.e., algorithms to decide inference problems for dependencies) can be interpreted as clever implementations of well known refutation procedures of first-order logic with resolution and paramodulation. On the one hand this alternative interpretation provides a deeper insight into the theoretical foundations of chase procedures, whereas on the other hand it makes available an already well established theory with a great amount of known results and techniques to be used for further investigations of the inference problem for dependencies. Our presentation is a detailed and careful elaboration of an idea formerly outlined by Grant and Jacobs which up to now seems to be disregarded by the database community although it definitely deserves more attention.

Abstract. Stable autoepistemic sets are treated as S4 maximal theories. This approach allows to use the Lindenbaum algebra of modal logic as a tool in investigations of existence of a special kind of stable sets. Namely, for a given set A, the algebraic constructions of minimal stable sets based on A and moderately grounded expansions of A are shown.

Abstract. Relations between general logical kits and kits of some particular type, called functional kits, are investigated. The functional representation $R(K)$ of a logical kit K is constructed and it is shown that $R(K)$ is a reflection of K in the category of kits and A-surjective kit homomorphisms with respect to the subcategory of functional kits.

Keywords. logical kit, knowledge representation system, functional kit, category, reflective subcategory.

Abstract. The purpose of this paper is to make the first step towards an approximation theory of discrete problems in which one can express and prove properties of approximating algorithms as

well as carry out an approximate reasoning. We introduce an approximation propositional dynamic logic (APDL) with approximations of programs and formulas. We discuss the expressibility of APDL. The main theorem is the completeness theorem for a fragment of APDL. We consider also the approximation problem of properties expressible in APDL by a distinguished set of so called simple approximate formulas and programs, generated only from approximations of atomic properties and approximations of atomic programs. The solution of the uniform approximation problem is presented and a result about an appoximation of decision algorithms is given.

15 (3-4) 1991

Abstract. This paper is an attempt to cast both uncertainty and time in a logical framework. It generalizes possibilistic logic, previously developed by the authors, where each classical formula is associated with a weight which obeys the laws of possibility theory. In the possibilistic temporal logic we present here, each formula is associated with a time set (a fuzzy set in the more general case) which represents the set of instants where the formula is certainly true (more or less certainly true in the general case). When a particular instant is fixed we recover possibilistic logic. Timed possibilistic logic generalizes possibilistic logic also in the sense that we substitute the lattice structure of the set of the (fuzzy) subsets of the temporal scale to the lattice structure underlying the certainty weights in possibilistic logic. Thus many results from possibilistic logic can be straightforwardly generalized to timed possibilistic logic. Illustrative examples are given.

Abstract. Two families of many-valued modal logics are investigated. Semantically, one family is characterized using Kripke models that allow formulas to take values in a finite many-valued logic, at each possible world. The second family generalizes this to allow the accessibility relation between worlds also to be many-valued. Gentzen sequent calculi are given for both versions, and soundness and completeness are established.

Abstract. We study monotonic and non-monotonic Logics of Knowledge, giving decision procedures and completeness results. In particular we develop a model theory for a non-monotonic Logic of Knowledge and show that it corresponds exactly to normal applications of a non-monotonic rule of inference due to McCarthy,

Abstract. Quantification in modal logic is interesting from a. technical and philosophical standpoint. Here we look at quantification in. autoepistemic logic, which is a. modal logic of self-knowledge. We propose several different semantics, all based on the idea that having beliefs about an individual amounts to having a. belief using a certain type of name for the individual.

Abstract. This paper explores the task of belief reasoning in light of the more basic cognitive principles of introspection and analogy-based reasoning. Using a syntactic framework, we show in detail how the ability to conduct belief reasoning can be reduced to principles of introspection and analogy-based reasoning.

Abstract. We address the problem of building intelligent systems to reason about linear arithmetic constraints, We develop, along the lines of Logic Programming, a unifying framework based on the concept of Parametric Queries and a quasi-dual generalization of the classical Linear Programming optimization problem. Variable (quantifier) elimination is the key underlying operation which provides an oracle to answer all queries and plays a role similar to Resolution in Logic Programming. We discuss three methods for variable elimination, compare their feasibility, and establish their applicability. We then address practical issues of solvability and canonical representation, as well as dynamical updates and feedback. In particular, we show how the quasi-dual formulation can be used to achieve the discriminating characteristics of the classical Fourier algorithm regarding solvability, detection of implicit equali-ties and, in case of unsolvability, the detection of minimal unsolvable subsets. We illustrate the relevance of our approach with examples from the domain of spatial reasoning and demonstrate its viability with empirical results from two practical applications: computation of canonical forms and convex hull construction.

Abstract. In our model of a distributed information system, two information structures are maintained - the application database and the (routing) database used to route queries in a computer network. Any site of a distributed information system which does not understand some attribute values used in a query has to search for a site which can explain them. The information stored in routing database has a strong impact on the speed of this search. In [5], we propose that each site learns from its neighbors the descriptions of all unknown attribute values used in queries. These descriptions are represented in the form of rules and stored in dictionaries added to all sites of a distributed information system. This extended distributed system with dictionaries is called intelligent.