A PROBLEM OF DOMAIN RESTRICTION IN DATA BASES A LOGICAL APPROACH

Andrzej W. Jankowski, Cecylia Rauszer   *1-25*

Abstract. The paper deals with the mathematical description of information systems with a limited access to a data base. Similarly as in [1] an area to which the user has access is called his priority. The information systems introduced in the paper are mathematical models for an intermediate logic with logical constants that corresponds to the priorities. The principles for operating this language are described, as well as a complete semantics is formulated.

EQUIVALENCE RELATIONS IN CLASSES OF STOCHASTIC AUTOMATA

Slawomir Janicki   *27-54*

Abstract. Hartoszynski raised and investigated problems of extensions and shrinkages of the Markov chain type stochastic automata (Some remarks on extensions of stochastic automata, Bull. Acad. Polon. Sci. S4r. Sol. Math. Aatronom. Phys. 18(1970), 551-556). By such an automaton we mean an ordered triple t, α, A, where T denotes a finite non-empty set, α is a function from T to $[0,1]$ with $\sum_{t \in T} \alpha(t) = 1$, and A is a function $T \times T \to [0,1]$ with $\sum_{t \in T} A(s,t) = 1$ for every $s \in T$. If an extension (shrinkage) of two automata exists, then we say that they satisfy the relation $R_e(R_s)$. The aim of this paper is to consider some classes of automate with the same set T in which the relations R_e and R_s are equivalence relations. We consider also some other relations in the class of stochastic automata. Moreover, in the first part we deal with extensions and shrinkages of probability measures.

ON PSEUDO-RANDOM SEQUENCES OVER FINITE AUTOMATA

Ivan Kramosil   *55-62*

Abstract. It is a well-known fact that binary sequences (strings) of high algorithmic complexity can be taken as good approximations of statistically independent random sequences with two equiprobable outputs. Here "sequence of high algorithmic complexity" is such one, that the length of the shortest program generating this sequence by a universal Turing machine differs only by an a priori given constant from the length of the generated sequence. The present paper generalizes this result to the case of a finite (not necessarily binary) alphabet. Considering an infinite sequence of finite sequences of high algorithmic complexity over a finite alphabet, the relative frequency of occurences of each letter or finite string of letters is proved to tend to the inverted value of the total number of letters, or strings of letters of the given length, in question. This result may be seen as an analogy to the strong law of large numbers in the case of equiprobable probability distribution.

NONDETERMINISTIC PROGRAMS DEFINABLE IN TYPED λ-CALCULUS

Marek Zaionc   *63-72*

Abstract. In this paper term grammars are introduced. The expressing power of this grammars with variables of natural number type are just the nondeterministic programs built up without composition but with iteration of extended polynomials.

ROUGH GRAMMARS

Janusz Kierczak 73-81

Abstract. In the paper we define the notions of the best lower and the best upper approximations of grammar, which are based on the concept of rough set introduced by Pawlak in [4]. Furthermore we give the properties of languages generated by the best lower and the best upper approximations of grammar.

Keywords: formal grammars, formal languages, rough sets, rough grammars, rough languages.

ONE-DIMENSIONAL LEARNING

Wiktor Marek, Zdzislaw Pawlak 83-88

Abstract. We study a simple model of learning process over an information system.

Keywords: learning, information system, definability.

ON THE SEMANTICS OF THE RELATIONAL. MODEL OF DATABASE I

Wiktor Marek 89-101

Abstract. We present a formalization of (tuple version) of Codd's relational model of database. The presentation stresses the ontological problems related with this model.

Keywords: database, relational model, tuple.

A SURVEY OF SOME RECENT RESULTS ON COMPUTATIONAL COMPLEXITY IN WEAK THEORIES OF ARITHMETIC

Joseph Deborah, Paul Young 103-122

Abstract. In spite of the fact that much effort has been expended trying to prove lower bounds for algorithms and trying to solve the $P = NP$ question, only limited progress has been made. Although most computer scientists remain convinced that solutions will be found, others (Hartmanis and Hoperoft, Fortune, Leivant and O'Donnell, and Phillips) have questioned the adequacy of Peano arithmetic for computer science. This uncertainty has only been increased by the recent work of Paris and Harrington showing that certain simple, finitistic, combinatorial statements are in fact independent of Peano Arithmetic. In this paper we survey complexity theoretic statements that are known to be independent of arithmetic theories. In addition we survey recent results analyzing the arithmetic quantifier structure of computational problems.

Keywords: Independence results, $NP =?coNP$, $P =?NP$, Peano arithmetic.

HOMOGENEOUS INFORMATION TREES

Keh-Hsun Chen, Zbigniew W. Raś 123-149

Abstract. By a homogeneous information tree we mean a tree with internal nodes labeled by attributes, edges by values of attributes and terminal nodes by sets of objects. Sets labeling terminal nodes form a partition of the set of objects classified by a homogeneous tree. Homogeneous information trees can be interpreted as models of expert systems, data bases with a menu or tree-structured data bases. The main problem we are dealing with concerns a minimization of a tree with respect to the storage cost. We propose a heuristic polynomial algorithm to construct an optimal tree.

Keywords: information tree, attributes, information retrieval, storage cost, optimization problem.

SEMICONDITIONAL CONTEXTUAL GRAMMARS

Gheorghe Păun   *151-161*

Abstract. One defines a class of contextual grammars "intermediate" between the conditional contextual grammars and the contextual grammars with bounded choice (the addition of each context depends on a prefix and a suffix of the current string which belong to a given pair of languages associated with this context). The paper investigates the generative capacity of these grammars compared to other contextual language families and with families in Chomsky hierarchy.

Keywords: Chomsky grammars, Marcus contextual grammars.

STRUCTURES DETERMINED BY PROPERTIES OF FINITE FAIEELIES OF ALGORITHMS

Wiktor Dańko   *163-197*

Abstract. In the paper the following problem stated by Tajtslin in 1979 is investigated: Let $\mathfrak{M} = < A; f_1, \ldots, f_n; r_1, \ldots, r_m >$ be a structure. Are there functions $f'_1, \ldots, f'_p$ and relations $f'_1, \ldots, f'_q$ definable in $\mathfrak{M}$ by means of algorithms such that every function relation definable over $\mathfrak{M}$ by an algorithm is first-order definable in $\mathfrak{M}^+ =< A; f_1, \ldots, f_n, f'_1, \ldots, f'_p; r_1, \ldots, r_m, r'_1, \ldots, r'_q >$?

Keywords: algorithms, programmability, logics of programs, algorithmic definability.

FREE GAMES OVER COLOURED AUTOMATA

Antoni Wiweger   *199-224*

Abstract. Concepts of category theory are applied to the investigation of some relations between automata and abstract games. The notion of a coloured automaton introduced in this paper provides a framework for a unified treatment of automata and abstract games. Both games and automata can be viewed as special cases of this general notion. A coloured automaton is defined to be a Mealy automaton with the additional structure of a coloured graph on the set of inputs. Various categories of coloured automata, automata, and games are described. It is shown that some forgetful functors between these categories have left adjoints, and explicit constructions of these adjoints are given. The main result is Theorem 5.5 which describes a construction of a free abstract game over a coloured automaton satisfying some additional conditions.

Keywords: automaton, coloured automaton, coloured araph, abstract game, category, free pair, adjoint functor.

EASY TERMS IN THE LAMBDA CALCULUS

Giuseppe Jacopini, and Marisa Venturini Zilli   *225-233*

Abstract. This paper, a revised version of the one [4] presented at the Logic Colloquium '82, concerns closed unsolvable λ-terms, named easy, which are terms such that they can be consistently equated to arbitrary closed ones. Some general results are obtained, mainly sufficient or necessary conditions for proving that an unsolvable λ-term is easy.

Keywords: lambda calculus, unsolvable terms, easy terms, extension of a theory.

EFFECTIVE CONSTRUCTION OF GRAMMARS FOR LANGUAGES OF TWO PARTICULAR CLASSES

Jan Ostrayský   *235-252*

Abstract. In this paper we solve inference problem for languages on two particular classes B^c, B^s, For any language $(V, L) \in B^j$, $j \in \{s, c\}$, and any natural number i, we define a grammar $G_i^j(V, L)$ in an effective way. We prove that $(V, L) \in B^j$ iff there exists a natural number i_0 such that $G_i^j(V, L) = G_{i_0}^j(V, L)$ for any $i \geq i_0$ the grammar $G_{i_0}^j(V, L)$ generates (V, L).

Keywords: special generalized grammar, special grammar, language generated by the (generalized) special grammar, norms, monotone productions or c-productions, context-free productions or s-productions, special grammar with s-productions, special grammar with c-productions, languages of the classes B^c and B^s, reducing operator, fragment of the language, relation $T_i(V, L)$ relation $T_i^j(V, L)$, special grammar $G_i^j(V, L)$.

ON GENERALIZED VECTOR SPACE MODEL IN INFORMATION RETRIEVAL

S.E.M. Wong, and Wojciech Ziarko   *253-267*

Abstract. In information retrieval, it is common to model index terms and documents as vectors in a suitably defined vector space. The main difficulty with this approach is that the explicit representation of term vectors is not known a priori. For this reason, the vector space model adopted by Salton for the SMART system treats the terms as a set of orthogonal vectors. In such a model it is often necessary to adopt a separate, corrective procedure to take into account the correlations between terms. In this paper, we propose a systematic method (the generalized vector space model) to compute term correlations di:ectly from automatic indexing scheme. We also demonstrate how such correlations can be included with minimal modification in the existing vector based information retrieval systems.

Keywords: information retrieval, vector space models.

AXIOMATIZABLE CLASSES IN MANY-SORTED LOGICS OF PROGRAMS

Wiktor Dańko   *269-283*

Abstract. In this paper many-sorted logics of programs are considered (cf. Wand [16] and [3]). The aim is to characterize classes of structures axiomatizable by sets of algorithmic formulas. The results are formulated in terms of operations on classes of structures axiomatizable in the first order logic.

Keywords: logics of programs, axiomatizable classes, algorithmic theories.

ON ENUMERATED ALGEBRAS AND SOME MONADS IN THE CATEGORY OF ENU-MERATED SETS

Andrzej Orlicki   *285-307*

Abstract. In this paper we investigate some properties of categories of enumerated algebras. In section 1 we prove that in case of the category of enumerated algebras satisfying some fixed set of identities the forgetful functor into the category of enumerated sets is monadic. Then in sections 2 and 3 some applications of this result are presented. In particular we show (see Theorem 3.2., section 3) that each finitary monad in the category of denumerable sets has a lifting to a monad in the category of enumerated sets.

Keywords: enumerated type of algebras enumerated algebra, monad, monadic functor, category of enumerated sets .

MONADIC SECOND ORDER DEFINABILITY AS A COMMON CHARACTERIZATION OF FINITE AUTOMATA, CERTAIN CLASSES OF PROGRAMS AND LOGICS

Anita Wasilewska   *309-320*

Abstract. We introduce the notion of monadic second order definability (m.s.o def inability) of automata, programs and logics and point out some classes of automata (theorem 7), programs (theorem 8) and logics (theorem 9) which are m.s.o definable.

Keywords: m.s.o definability, finite automaton, FC-algorithm, theorem proving system.

CATEGORICAL MODELS FOR HANDSHAKING COMMUNICATIONS

Anna Labella, and Alberto Pettorossi   *321-357*

Abstract. Various languages, formalisms and algebraic structures have been recently proposed for denoting parallel computations and communications among processes. As in [LaP 83] we restrict our attention to the CCS [Mil 80] and CSP [Hoa 78] languages. We provide categorical models for their basic constructs and operations. The parallel composition and other kinds of interactions among computing processes will be interpreted as categorical constructions in suitable categories.

Keywords: categorical models, parallel computations, communicating systems, CCS and CSP languages.

LOGIC APPROACH TO INFORMATION SYSTEMS

Ewa Orłowska   *359-378*

Abstract. The purpose of the present paper is to give a logical framework which provides a uniform description of Pawlak's information systems of deterministic, nondeterministic, and many-valued information. A language is introduced for representing and retrieving information. Logical aspects of dynamics of information systems are discussed.

Keywords: information system, deterministic information, nondeterministic information, many-valued information, query language, predicate logic.

FINITE AUTOMATA ON TRANSFINITE SEQUENCES AND REGULAR EXPRESSIONS

Jerzy Wojciechowski   *379-396*

Abstract. In this paper the notion of regular expression for finite automata on transfinite sequences /TF-automata/ is introduced. The characterization theorem for TF-automata is proved. From this theorem we conclude the decidability of the emptiness problem for TF-automata and the characterization theorem for finite automata on transfinite sequences of bounded lenght.

Keywords: finite automata, tranefinite sequences, regular expressions.

QUADRATIC-TIME OPTIMIZATION OF SPJ-EXPRESSIONS INCLUDING INEQUALITY SELECTIONS BY TABLEAUX

Alois Peter Heinz, Gottfried Vossen   *397-414*

Abstract. The problem of optimizing algebraic queries to relational databases which are formulated with the help of inequality selection, projection, and natural join is addressed: We generalize the well-known tableau formalism to handle this type of queries and provide a quadratic-time optimization procedure. We show how optimized tableaux can be translated back into extended SPJ-expressions, thereby dispensing with the computationally harder cartesian product.

Keywords: relational databases, relational algebra, query optimization, tableaux.