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Abstract. We study a term-language, which is used by the ."Warsaw-School" in an abstract model for information systems. Various normal forms as well as standard expansions with respect to product terms are formulated and proved correct. It is shown that the shortest sums of so-called maximal sub-products are the shortest representations of terms and algorithms for their generation are given.

Keywords: Information system, query language, terms, normal forms.

Abstract. It is shown that each Gödel numbering is effective sum of infinitely many pairwise incomparable Friedberg numberings, the complexity of which set of Friedberg numberings can be of any ordinal type.

Keywords: Enumerations, Gödel numbering, Friedberg numbering, translators.

Abstract. Given the input-output behavior of a stochastic automaton and a map which compares output words, optimal controls are introduced, and an explicit formula for such a control is derived by means of linear programming techniques. The second part of the paper deals with the situation in which an input and an output word are given and the probability with which the optimal control puts out the word is requested. An algorithm for computing this probability is presented and analysed with respect to its behavior in the worst and in the average case. The latter analysis develops some new techniques, which are necessary since an uncountable variety of possible inputs has to be considered. These techniques come mainly from real analysis, in particular from measure theory.

Keywords: Stochastic automata, optimal control, linear programming, analysis of algorithms, average complexity.

Abstract. This paper presents a characterization of congruences on algebraic and iteration theories. The characterization is used to obtain (1) a subdirect decomposition of the free iteration theory, (2) an infinite class of subdirectly irreducible iteration theories, (3) a simple iteration theory not embeddable in the iteration theory $[X, 0]$ of 'partial functions', and (4) a condition ensuring that a congruence on the algebraic theory of finite trees is the restriction of a congruence on the algebraic theory of all trees.

Keywords: Algebraic and iteration theories, iterative theories, trees.

DYNAMIC INFORMATION SYSTEMS

Ewa Orłowska *101-118*

Abstract. A model of information systems such that data depend on a state of the system is introduced. A logic is developed enabling us to define query languages for such systems.

Keywords: Information system, query language, tense logic, Boolean algebra.

ON THE UNWINDING OF FLOW-CHARTS WITH STACKS

Paweł Urzyczyn *119-126*

Abstract. Let A be a structure with the property that every flow-chart with one stack /every recursive schema/, total over A, is strongly equivalent in A to a loop-free schema. We show that every total flow-chart with one stack can be unwound in A.

Keywords: The unwind property, flow-chart with one stack, recursive program schema.

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Abstract. In this paper, a characterization of the sets of normal forms which are monoids with respect to the composition combinator is obtained as application of the type theory to λ-calculus developed in [5]. The main result is that there is a monoid of normal form which is maximal in the sense that all extensions lead to terms without normal forms.

Keywords: Type, λ-calculus, normal form, termination property.

Abstract. In [5] it has been proved that by using hidden functions the number of equations needed to specify a finite data type is bounded by numbers depending only on the signature of that data type. In the special case of a finite minimal unoid, however, it seems to be relevant to ask whether or not a specification can also be made by a bounded number of equations using only unary hidden functions.
In this paper we prove that this can be done.

Keywords: Algebraic data types; finite data types; unoids; equational specifications with hidden functions; boundedness properties.

Abstract. A review is given of some of the late C. C. Elgot's ideas on the syntax and semantics of monadic flowchart algorithms. In particular, the motivation for his "iterative algebraic theories" is explained.

Abstract. It is known that it is possible to impose a metric on the free iteration theory Γtr of Γ-trees such that the iterate $f^\dagger$ of any tree $f : n \to p + n$ is a limit of of 'finite approximations' of f. Since this notion of limiting computation corresponds to our intuitive notion of iteration, it is natural to ask which other theories in the variety Generated by Γtr admit such a metric. An algebraic characterization of these theories is presented In this paper.

Keywords: Iterative theories, fixed points,

Abstract. We introduce the notions of homogeneity of generalized Petri nets and of sufficiently marked place sets which are basic for our generalization of COMMONERs liveness theorem to a subclass of all generalized Petri rots. We show that a corresponding decision problem (the nonsufficiency problem) is equivalent with the reachability problem.

Keywords: Petri net; liveness, extended-free-choice nets; reachability problem.

A SUFFICIENT CONDITION FOR THE CONSISTENCY OF *P=NP* WITH PEANO ARITHMETIC

Wojciech Kowalczyk *233-245*

Abstract. In this paper we show how the indicators technique due to Paris and Kirby may be used to obtain independence or consistency results in Computer Science. We give an example of a sentence which is independent of PA and we formulate a sufficient condition for the consistency of $P = NP$ with Peano Arithmetic.

Keywords: Independence, consistency, nonstandard model of Peano Arithmetic, indicator, provably recursive function, $P = NP$ problem.

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AN OPERATOR PRECEDENCE PARSING ALGORITHM

Enrico Fischetti, Roberto Smaldone *247-260*

Abstract. Operator precedence parsers suffer the disadvantage of parsing invalid as well valid strings. This problem is scrutinized in relation to previous papers of Henderson and Levy (3) and Williams (4) and a parsing algorithm is put forward, capable of parsing a large class of operator precedence grammars.

Keywords: Formal languages, operator precedence grammars.

COMPLEXITY OF CRAIG'S INTERPOLATION

Daniele Mundici *261-278*

Abstract. In this paper we investigate the length $||\chi||$ of the shortest interpolant of a valid implication $\varphi \to \psi$ in terms of $||\varphi|| + ||\psi||$, both in sentential and in first-order logic. In the case of sentential logic, we give a precise exponential upper bound for $||\chi||$. We also show that the information about the growth of $||\chi||$ has some implications for computation theory. In the case of first-order logic we exhibit a very short valid implication whose interpolants are all impossibly long.

Keywords: Valid implication, logical circuit, interpolant, delay complexity.

TREE REWRITING SYSTEMS, COMBINATORY WEAK REDUCTION SYSTEMS AND TYPE FREE LANGUAGES

Alberto Pettorossi *279-299*

Abstract. In this paper we consider combinators as tree transducers: this approach is based on the one-to-one correspondence between terms of Combinatory Logic and trees, and on the fact that combinators may be considered as transformers of terms. Since combinators are terms themselves, we will deal with trees as objects to be transformed and tree transformers as well. Methods for defining and studying tree rewriting systems inside Combinatory Weak Reduction Systems and Weak Combinatory Logic are also analyzed and particular attention is devoted to the problem of finiteness and infinity of the generated tree languages (here defined). This implies the study of the termination of the rewriting process (i.e. reduction) for combinators.

Keywords: Combinatory Logic, Combinatory Weak Reduction Systems, Tree Languages, Tree Transducers, Trmination, Rewriting Systems, Type Free Languages.

PSEUDO-RANDOM MONTE-CARLO METHODS

Ivan Kramosil *301-312*

Abstract. In this paper we investigate the Monte-Carlo method for estimation of the unknown probability of a random event on the ground of relative frequencies and under the condition that random sampling is replaced by a deterministic side input producing binary sequences of high algorithmic complexity. It is proved that if this complexity exceeds a treshold value, the sequences may be used in the Monte-Carlo methods instead of random samples as the obtained estimates converge to the estimated probability when the length of these binary sequences increases.

Keywords: Monte-Carlo methods, random sampling, statistical estimates, pseudo-random numbers, universal Turing machine, binary strings, algorithmic complexity.

AN EXAMPLE OF A COMPLETE FIRST-ORDER THEORY WITH ALL MODELS ALGORITHMICALLY TRIVIAL BUT WITHOUT LOCALLY FINITE MODELS

Paweł Urzyczyn *313-318*

Abstract. We show an example of a first-order complete theory T, with no locally finite models and such that every program schema, total over a model of T, is strongly equivalent in that model to a loop-free schema. For this purpose we consider the notion of an algorithmically prime model, what enables us to formulate an analogue to Ryll-Nardzewski Theorem.

Keywords: Program schemas, algorithmically trivial and algorithmically prime structures, eds-complete theories.

ON SOME EXTENSION OF THE QUERY LANGUAGE FOR INCOMPLETE INFORMATION SYSTEMS

Tomasz Imieliński *319-342*

Abstract. In the paper properties of en extension of a query language for incomplete information systems by a new descriptor "known(i)" are examined. Introducing a new descriptor "known(i)" allows to distinguish the objects about which our knowledge is complete, and increases the descriptive power of the language. It is shown that every query (term) is equivalent to a term in a simpler canonical form. Completeness results are presented.

Keywords: Query languages, incomplete information, data bases.