

CUMULATIVE SUBJECT INDEX¹ Volumes 52-55

A

Agreement

Byzantine, without authentication: efficient algorithm for, **52**, 257

Algebraic specification

methods for computable data types, completeness, **54**, 186

Algebraic systems of equations

over free monoid, and test sets for context free languages, **52**, 172

Algorithm

direct branching, for checking equivalence of deterministic pushdown automata, **52**, 187

efficient, for Byzantine agreement without authentication, **52**, 257

regular languages of star height one, **53**, 199

Alternating Turing machine

two-dimensional, with only universal states, **55**, 193

Announcements

automata, languages, and programming: 11th colloquium, **52**, 365

open mathematical problems, call for, **53**, 139

semioticians, prize, **52**, 239

Array

as parametrized data type, **52**, 139

Asymmetric error detecting codes

properties, optimal, **53**, 66

Attribute systems

equivalence problem for, **52**, 275

Automata

deterministic pushdown, direct branching algorithm for checking equivalence, **52**, 187

pushdown, with bound on size of pushdown store, **54**, 217

universal, with uniform bounds on simulation time, **52**, 19

Axiomatic systems

for models, stochastic systems with state transition probabilities, **53**, 165

B

Backtracking

construct in propositional dynamic logic, **54**, 121

Berkling reduction language

and lambda calculus extension, **55**, 89

Binary block codes

enumeration of run length sequences, **55**, 222

Block codes

binary, enumeration of run length sequences, **55**, 222

Block symmetry

in Shannon entropy characterization, **53**, 9

Boolean formula

and unique satisfiability problem, **55**, 80

Boolean functions

nondegenerated, time bound for parallel RAM's computation, **55**, 102

Bound

lower, circuit size: and non-reducibility to sparse sets, **55**, 40

tight $\Omega(\log \log n)$, on time for parallel RAM's to compute nondegenerated Boolean functions, **55**, 102

uniform, on simulation time: universal automata with, **52**, 19

Busy beaver sets

characterization and applications, **52**, 52

Byzantine agreement

without authentication, efficient algorithm for, **52**, 257

¹ Boldface number indicates appropriate volume; lightface number indicates pagination.

C

- Calculus
 dyadic, and sampling theorems
 applications to dyadic sampling representations, 52, 352
 theory, 52, 333
 lambda, model, 52, 87, 306
- Calculus for communicating systems
 language, in denotational semantics of concurrency, 54, 70
- Cardinality codes
 maximum, determination, 53, 66
- Cartesian closed monoids
 of lambda algebra, 52, 306
- Categorical models
 and lambda calculus, 52, 306
- Cell space
 universal, Petri net implementations by, 53, 121
- Chance
 and time, reasoning with, 53, 165
- Channel
 \bar{d} -continuous conditionally almost block independent, representation, 55, 238
 discrete stationary, with memory: distance measures, 55, 238
 distances and representation, 55, 238
- Church's thesis
 in history of ideas and models of computer science, 54, 3
- Circuit-size lower bounds
 and non-reducibility to sparse sets, 55, 40
- Codes
 binary block, enumeration of run length sequences, 55, 222
 cardinality, maximum: determination 53, 66
 error detecting, asymmetric: properties, 53, 66
 Kerdock, generalized: exponential number, 53, 74
- Combinational logic network
 linear cost, 55, 20
- Combinators
 and lambda terms, relation, 52, 87
- Comparison
 criteria of language learning, 52, 123
- Complexity
 computational
 and busy beaver sets, 53, 52
 recursively enumerable sets, 52, 8
 total variation and differentiation, 53, 21
 derivational, context-free grammars, 53, 52
 distributed protocol designing, 53, 211
 NP, analogues of semirecursive sets and effective reducibilities and, 52, 36
 recursion-theoretic
 of relative succinctness of representations of languages, 52, 2
 of semantics of predicate logic as programming language, 54, 25
 time, deterministic and nondeterministic, 55, 117
 validity problem for dynamic logic, 54, 48
- Complexity classes
 computational, probabilistic: under definitional perturbations, robustness, 54, 143
 R and ZPP, robustness under definitional perturbations, 54, 143
- Communicating sequential processes
 language, in denotational semantics of concurrency, 54, 70
- Communication
 concept in denotational semantics of concurrency, 54, 70
- Computable data types
 algebraic specification methods for, 54, 186
- Computation
 and decision-making, complexity of designing distributed protocols, 53, 211
 greatest common divisor, fast parallel matrix and, 52, 241
 infinite, propositional dynamic logic extensions for, 55, 175
- Computational complexity
 and busy beaver sets, 52, 52
 recursively enumerable sets, 52, 8
 total variation and differentiation, 53, 21
- Computational complexity classes
 probabilistic, under definitional perturbations: robustness, 54, 143
- Computer science
 recursion theoretic aspects
 history of ideas and models, 54, 3
 National Science Foundation sponsored workshop, special issue, introduction, 52, 1; 54, 1

Concurrency
 denotational semantics of, 54, 70

Conditionally almost block independent channels
 \bar{d} -continuous, distances and representation, 55, 238

Context-free grammars
 derivational complexity, 53, 52
 fair derivations in, 55, 108
 $LL(k)$ parsing, 53, 141
 languages, test sets for, 52, 172

Continuous-time systems
 entropy theorem for parameter estimation extension to, 53, 81

Criteria
 language learning, 52, 123

D

Database
 relational, and template dependency, 55, 69

Data types
 computable, algebraic specification methods for, 54, 186
 parametrized, fixpoint approaches, 52, 139

Decision-making
 and computation, complexity of designing distributed protocols, 53, 211

Definitional perturbations
 robustness of R and ZPP under, 54, 143

Denotational semantics
 of concurrency, 54, 70

Dependencies
 template, inference problem for, 55, 69

Derivations
 context-free grammars, complexity, 53, 52
 fair, in context-free grammars, 55, 108

Deterministic pushdown automata
 direct branching algorithm for checking equivalence, 52, 187

Differentiation
 computational complexity, negative results, 53, 21

Digital images
 three-dimensional, recognition of surfaces in, 53, 108

Digital optical disks
 and write-once memory, 55, 1

Domain
 multidimensional, functions with: dyadic calculus and sampling theorems for, 52, 333, 352

Dyadic calculus
 and sampling theorems
 applications to dyadic sampling representations, 52, 352
 theory, 52, 333

Dyadic sampling representations
 dyadic calculus and sampling theorems applied to, 52, 352

Dynamic logic
 looping and repeating in, 55, 175
 propositional, of looping and converse: elementarily decidable, 54, 121
 validity problem, complexity, 54, 48

E

Editorial
 Editorial Board, new, 52(1), iii

Effective reducibilities
 and NP complexity, 52, 36

Entropy
 Shannon, characterization: using extreme symmetry and block symmetry, 53, 9
 theorem, for parameter estimation: extension, 53, 81

Enumeration
 run length sequences, binary block codes, 55, 222

Environmental structures
 and lambda calculus, 52, 306

Equations
 algebraic systems of, over free monoid: and test sets for context-free languages, 52, 172

Equivalence
 algorithm for checking, deterministic pushdown automata, 52, 187
 problem, for attribute systems, 52, 275

Error detecting codes
 asymmetric, properties: optimal, 53, 66

Execution sequences
 properties, formulas, 53, 165

Exponential number
 Kerdock codes, generalized, 53, 74

Extreme symmetry
 in Shannon entropy characterization, 53, 9

- F
- Fairness
 derivations in context-free grammars, **55**, 108
- Fast parallel matrix
 and gcd computations, **52**, 241
- Filter lambda model
 characterizations theorems for, **54**, 201
- Fixpoint
 approaches to data types, **52**, 139
- Free monoid
 algebraic systems of equations over, and test sets for context-free languages, **52**, 172
- Fringe analysis
 theory, application to 2–3 trees and B-trees, **55**, 125
- Function
 Boolean, nondegenerated: time bound for parallel RAM's computation, **55**, 102
 bounded variation, **53**, 21
 with multidimensional domain, dyadic calculus and sampling theorems for, **52**, 333, 352
- Functional programming languages
 lambda calculus extension base, **55**, 89
- G
- gcd, *see* Greatest common divisor
- Global invariants
 in transition systems, **53**, 91
- Gödel
 and Church's thesis, **54**, 3
 and history of ideas and models of computer science, **54**, 3
- Grammar
 attribute, semantics, **52**, 275
 context-free
 derivational complexity, **53**, 52
 fair derivations in, **55**, 108
 LL(k) parsing, **53**, 141
 sequential, continuous, and parallel [corrigendum to **48**, 221 (1981)], **52**, 364
- Greatest common divisor
 computations, fast parallel matrix and, **52**, 241
- H
- Hierarchy
 fine, and tape versus pushdown, **54**, 217
- Hoare's logic
 incompleteness result for, **52**, 159
- I
- Images
 digital, three-dimensional: recognition of surfaces in, **53**, 108
- Incompleteness
 result for Hoare's logic, **52**, 159
- Inductive inference
 nearly minimal size programs, tradeoffs in, **52**, 68
- Inference
 inductive, of nearly minimal size programs: tradeoffs in, **52**, 68
 problem for template dependencies, **55**, 69
- Information
 storage, and balanced search trees, **55**, 125
- Invariant
 global and local, in transition systems, **53**, 91
- K
- Kerdock codes
 generalized, exponential number, **53**, 74
- L
- Lambda algebra
 and lambda calculus, **52**, 306
- Lambda calculus
 extension, base for functional programming languages, **55**, 89
 filter lambda model, **54**, 201
 model, **52**, 87, 306
- Language
 acquisition, models and learning strategies, **53**, 32
 Berkling reduction, and lambda calculus extension, **55**, 89
 context free, test sets for, **52**, 172
 in denotational semantics of concurrency, **54**, 70

- functional programming, lambda calculus
 extension base, 55, 89
 learning, criteria, 52, 123
 natural, learning strategies, 53, 32
 in NP, 52, 36
 picture, description using string languages,
 54, 155
 programming, predicate logic as, 54, 25
 regular, star height one, 53, 199
 relative succinctness, recursion-theoretic
 complexity of, 52, 2
 reversal-bounded counter machine, fine
 hierarchy, 54, 217
 string, to describe picture languages, 54,
 155
- Learning
 language, criteria, 52, 123
 machines, and learning strategies, 53, 32
 strategies, 53, 32
- Local invariants
 in transition systems, 53, 91
- Logic
 dynamic
 looping and repeating in, 55, 175
 validity problem, complexity, 54, 48
 Hoare's, incompleteness result for, 52, 159
 network, combinatorial: linear cost, 55, 20
 predicate, as programming language:
 recursion-theoretic complexity of
 semantics of, 54, 25
 propositional dynamic, of looping and
 converse: elementarily decidable, 54,
 121
- Looping
 construct in propositional dynamic logic,
 54, 121
 and repeating in dynamic logic, 55, 175
- Lower bounds
 circuit size, and non-reducibility to sparse
 sets, 55, 40
- M
- Machines
 inductive inference, and nearly minimal
 size programs: tradeoffs, 52, 68
 multicounter, efficient simulations, 55, 20
 reversal-bounded counter, fine hierarchy,
 54, 217
 Turing
 alternating, two-dimensional: with only
 universal states, 55, 193
 and Gödel's thinking, 54, 3
 k tape, simulation by, 53, 1
- Matrix
 in fringe analysis problems, 55, 125
 parallel, fast: and gcd computations, 52,
 241
- Memory
 write-once, reuse, 55, 1
- Memory-limitedness
 learning strategy, 53, 32
- Model
 \bar{a} -continuous conditionally almost block
 independent channels, distance mea-
 sures, 55, 238
 filter lambda, characterization theorems
 for, 54, 201
 lambda calculus, 52, 87, 306
- Monoids
 Cartesian closed, of lambda algebra, 52,
 306
 free, algebraic systems of equations over:
 and test sets for context-free
 languages, 52, 172
- Multicounter machines
 simulations, efficient, 55, 20
- Multidimensional domain
 functions with, dyadic calculus and
 sampling theorems for, 52, 333, 352
- N
- National Science Foundation
 sponsored workshop, recursion theoretic
 aspects of computer science: special
 issue, introduction, 52, 1
- Negative results
 computational complexity of total
 variation and differentiation, 53, 21
- Net
 Petri, implementations by universal cell
 space, 53, 121
- Nondegenerated Boolean functions
 time bound for parallel RAM's com-
 putation, 55, 102
- Nondeterministic polynomial (NP)
 complexity, and analogues of semi-
 recursive sets, 52, 36

- Nonlinear time
 in simulation by k tapes, 53, 1
- Nontriviality
 learning strategy, 53, 32
- NP, *see* Nondeterministic polynomial
- Number
 exponential, generalized Kercock codes, 53, 74
- O
- Optical disks
 digital, and write-once memory, 55, 1
- Oracle
 construction, and unique satisfiability problem, 55, 80
- Orientability
 and connectedness, surfaces in three-dimensional digital images, 53, 108
- P
- Parallellism
 concept in denotational semantics of concurrency, 54, 70
- Parallel matrix
 fast, and gcd computations, 52, 241
- Parallel RAM
 computation of nondegenerated Boolean functions, tight $\Omega(\log \log n)$ -bound on time for, 55, 102
- Parameter
 estimation, entropy theorem for, 53, 81
- Parametrized data types
 fixpoint approaches, 52, 139
- Parser
 LL(k), construction, 53, 141
 optimization, and derivational complexity of context-free grammars, 53, 52
- Parsing
 LL(k), context-free grammars: theory, 53, 141
- Perturbations
 definitional, robustness of R and ZPP under, 54, 143
- Petri net
 implementations by universal cell space, 53, 121
- Picture languages
 description, using string languages, 54, 155
- Ping-pong protocols
 security, 55, 57
- Polynomial
 greatest common divisor, 52, 241
 nondeterministic, complexity: and analogues of semirecursive sets, 52, 36
- Predicate logic
 as programming language, recursion-theoretic complexity of semantics of, 54, 25
- Probabilistic computational complexity classes
 under definitional perturbations, robustness, 54, 143
- Probabilistic programs
 reasoning with time and chance, 53, 165
- Processes
 and denotational semantics of concurrency, 54, 70
- Program
 nearly minimal size, tradeoffs in inductive inference of, 52, 68
 scheme, recursive, 52, 275
- Programming language
 functional, lambda calculus extension base, 55, 89
 predicate logic as, 54, 25
- Promptly simple sets
 computational complexity notions for recursively enumerable sets, 52, 8
- Propositional dynamic logic
 of looping and converse, elementarily decidable, 54, 121
- Protocols
 distributed, designing: complexity, 53, 211
 ping-pong, security, 55, 57
- Pseudomodels
 and lambda calculus, 52, 306
- Pushdown automata
 with bound on size of pushdown store, 54, 217
- Pushdown store
 and tape for two-way machines, comparison, 54, 217
- Q
- Queues
 and stacks, in data types, 52, 139

R

R, *see* Complexity classes

Reasoning

with time and chance, 53, 165

Recursion theoretic aspects

computer science, National Science Foundation sponsored workshop: special issue, introduction, 52, 1; 54, 1

Recursion-theoretic complexity

relative succinctness of representations of languages, 52, 2

of semantics of predicate logic as programming language, 54, 25

Recursion theoretic formulation

and universal automata, 52, 19

Recursive function

and Gödel's thesis, 54, 3

theory, and busy beaver sets, 52, 52

Recursively enumerable sets

computational complexity, 52, 8

Reducibilities

effective and efficient, and *NP* complexity, 52, 36

Relative succinctness

of representations of languages, recursion-theoretic complexity of, 52, 2

Repeating

and looping in dynamic logic, 55, 175

Representation

\bar{a} -continuous conditionally almost block independent channel, as infinite sliding-block coding, 55, 238

sampling, dyadic: dyadic calculus and sampling theorems applied to, 52, 352

Reuse

write-once memory, 55, 1

Run length sequences

enumeration, binary block codes, 55, 222

S

Sampling representations

dyadic, dyadic calculus and sampling theorems applied to, 52, 352

Sampling theorems

for functions with multidimensional domain, dyadic calculus and, 52, 333, 352

Satisfiability problem

unique, oracle construction, 55, 80

Search trees

and fringe analysis, 55, 125

Security

ping-pong protocols, 55, 57

Semantics

denotational, of concurrency, 54, 70

of predicate logic as programming language, recursion-theoretic complexity of, 54, 25

Sequences

run length, enumeration: binary block codes, 55, 222

Sequential and parallel grammars

continuous [corrigendum to 48, 221 (1981)], 52, 364

Sets

busy beaver, characterization and applications, 52, 52

promptly simple, computational complexity notions for recursively enumerable sets, 52, 8

recursively enumerable, computational complexity, 52, 8

semirecursive, analogues: and *NP* complexity, 52, 36

sparse, and circuit-size lower bounds, 55, 40

speedable, computational complexity notions for recursively enumerable sets, 52, 8

test, for context-free languages and algebraic systems of equations over free monoid, 52, 172

Semirecursive sets

analogues, and *NP* complexity, 52, 36

Shannon entropy

characterization, using extreme symmetry and block symmetry, 53, 9

Simulation

by *k* tape Turing machines, 53, 1

multicounter machines, 55, 20

Simulation time

uniform bounds on, universal automata with, 52, 19

Sparse sets

non-reducibility to, circuit-size lower bounds and, 55, 40

Speedable sets

computational complexity notions for recursively enumerable sets, 52, 8

- Stacks
 - and queues, in data types, 52, 139
- Star
 - height one, regular languages of, 53, 199
- States
 - universal, only: two-dimensional alternating Turing machines with, 55, 193
- Storage
 - information, and balanced search trees, 55, 125
- Strategies
 - learning, 53, 32
- String languages
 - use for description of picture languages, 54, 155
- Succinctness
 - relative, of representations of languages: recursion-theoretic complexity of, 52, 2
- Surfaces
 - in three-dimensional digital images, recognition, 53, 108
- Symmetry
 - block, in Shannon entropy characterization, 53, 9
 - extreme, in Shannon entropy characterization, 53, 9
- Synchronization
 - concept in denotational semantics of concurrency, 54, 70
- Systems
 - algebraic, equations over free monoid: and test sets for context-free languages, 52, 172
 - transition, global and local invariants in, 53, 91
- for context-free languages and algebraic systems of equations over free monoid, 52, 172
- Theorem
 - entropy, for parameter estimation: extension, 53, 81
 - sampling, for functions with multidimensional domain: dyadic calculus and, 52, 333, 352
- Three-dimensional images
 - digital, surfaces in: recognition, 53, 108
- Time
 - and chance, reasoning with, 53, 165
 - complexity, deterministic and nondeterministic, 55, 117
 - nonlinear, in simulation by k tapes, 53, 1
 - simulation, uniform bounds on: universal automata with, 52, 19
 - tight $\Omega(\log \log n)$ -bound, for parallel RAM's computation of nondegenerated Boolean functions, 55, 102
- Totality
 - learning strategy, 53, 32
- Transition
 - systems, global and local invariants in, 53, 91
- Trees
 - search (2-3 and B), fringe analysis, 55, 125
- Turing machine
 - alternating, two-dimensional: with only universal states, 55, 193
 - and Gödel's thinking, 54, 3
 - k tape, simulation by, 53, 1

U

- T
- Tape
 - and pushdown store for two-way machines, comparison, 54, 217
- Taxonomy
 - criteria of language learning, 52, 123
- Template
 - dependencies, inference problem for, 55, 69
- Test sets
 - only, two-dimensional alternating Turing machines with, 55, 193
- Uniform bounds
 - on simulation time, universal automata with, 52, 19
- Unique satisfiability problem
 - oracle construction, 55, 80
- Universal automata
 - with uniform bounds on simulation time, 52, 19
- Universal states
 - only, two-dimensional alternating Turing machines with, 55, 193

V

Validity
 in dynamic logic, complexity, 54, 48

Variation
 total, negative results on computational
 complexity of, 53, 21

W

Write-once memory
 reuse, 55, 1

Z

ZPP, *see* Complexity classes