

Index

- ABT 149, 150, 151, 153, 154
ACLS 307, 319, 423-33
 description of 425-8
 intelligibility of solutions 424, 432
 performance of 423-5, 429-32, 432-3
 termination rules 428, 433
Ada 157, 160, 161, 162, 163, 164
advice generation 132-3, 142, 149-54
ALI 375-6
Anna 157, 158, 160-4
annotations (of programs) 160, 161, 162
AOCDL 289, 290, 291, 298, 301-2, 303
APES 209, 213-16, 231, 233, 234, 256
AQ algorithm 267-70, 272
arc consistency 134, 135-9, 140, 144
arrythmia-ECG knowledge bases 447-53
arrythmias, cardiac 436, 439, 447, 449
assertions 24, 160, 196-200, 202
assignment 33, 46
ASSISTANT 308, 309, 310
assumptions, non-negative 111
assumptions, tentative 243, 244, 258
ATEST 273
atoms 169, 188
attributes 265, 291, 292, 306, 319, 320
 binary 309, 315
 class 322
 compound 328
 decider-status of 292-4, 298
 domains of 265, 272, 328
 external 325, 326
 integer 425
 linear 265
 multi-valued 290, 308-9, 311, 317
 nominal 265
 primitive 319, 320, 324, 325, 326
 redundant 305, 314-16, 318
 weights of 324
- Backtrack, Advised, *see* ABT
Backtrack, Regular, *see* RBT
- Backtrack algorithm 126, 129-32, 133
backtrack-free solutions 133, 135, 137
backtracking 33, 74, 78, 125, 178-9, 445
bindings 69, 70, 74, 78
biological systems 333-4, 336
British Nationality Act program 228-34,
 235, 245, 246, 247, 249-51
- C 320, 325, 326
case law 217, 218, 226; 244, 249, 250
CBIAS (coverage bias) 404
cells 193, 194, 195, 204, 205-7
certainties 167, 174, 175-6, 187, 188, 189,
 190
 calculus of 176, 177
chess endgames 290
 KBBKN (or BBN) 347-72, 378-89
 automata after ID3-like induction 388-9
 'box' in 362-4, 365
 example move sequences 381, 382,
 384-7
 five phases of 350-1
 in master practice 369-72
 patterns in 365-8
 'pseudo-fortress' in 360-1, 362, 363
 result of sequence induction 388
 results of tests 352-3, 368-9
 'squinting' bishops in 364
 strategies of domain specialist 353,
 358-64
 sub-strategy selection 379-80
 sub-strategy solution 381-2
 task of domain specialist 348-9
 see also Kling and Horwitz position
 KPa7KR 321, 328-31, 382
 KPK 271, 275-6, 278, 279, 281-2, 376
chess research, computer 375-6
choice points 170
chromosome classification 423-5, 429-33
circumscription 4, 8-9, 12, 13

INDEX

- citizenship, British 224, 228-34, 235, 245, 247, 250
 clashes 292, 323, 328, 378
 classes 265, 266, 291, 292, 305, 306
 classification rules 305, 306, 307, 308, 309, 398
 classifiers, distance 428-9
 classifiers, likelihood 428, 432
 classifiers, linear 423, 424, 429, 432
 classifiers, statistical 424, 431
 clauses 96, 118-20, 171
 see also Horn clauses
 CLS 309, 376
 CLUSTER 376
 completeness 39-45, 48-9, 50, 51, 52, 266
 completion procedures 28
 complexes 266, 267-70, 276, 278, 283
 concept acquisition, symbolic 265
 concept descriptions 263, 264, 265, 266
 characteristic 263, 264, 266-7, 270-1, 275, 283-4, 287
 characteristic conjunctive (CC) 264, 267, 285
 characteristic disjunctive (CD) 265, 267, 274-5, 278, 279-80, 283, 284
 complete 266, 267, 284
 conjunctive 264, 270, 284
 consistent 266, 284, 285
 discriminant 263, 264, 266-7, 270-1, 275, 284, 287
 discriminant conjunctive (DC) 265
 discriminant disjunctive (DD) 265, 274-5, 278, 279-80, 283
 disjunctive 264, 276, 279, 287
 concept recognition rules 265
 conclusions, disjunctive 219, 220, 221, 222
 conditions, disjunctive 222-3
 confluence 38-9, 44, 47, 49, 50, 51
 ground 39, 40, 41, 42, 49, 50
 congruence-closure algorithms 47
 conjectures 3, 5-8, 17-18
 'connection machine' architecture 337
 consistency checks 149, 150, 151, 152, 153, 154
 consistency conditions 4, 6
 constraint graphs 127, 133, 134-5, 137, 141, 142
 constraints, binary 126, 127, 128, 145
 networks of 126-7, 128, 129-31, 142-5, 147, 148-9
 weights of 144, 145, 147, 148, 149
 constraint-satisfaction problems (CSPs) 125, 126, 151
 east 133, 135, 142
 solutions of 128, 130, 131, 142
 tree-like 135, 137
 contexts 86, 104, 106, 107
 convective instability 394, 395
 coverage, areal 404
 coverage bias (CBIAS) 404
 Critical Skill Index, *see* CSI
 cross-multiply and add procedure 89, 93, 120
 CSI (Critical Skill Index) 391, 392, 402, 403
 'cuts' 33, 34

 data bases
 augmenting 95, 108, 112-14, 115, 116, 118
 combinatorial 347, 348, 350, 365, 369, 372, 379
 deductive 247
 deriving equalities from 117
 incremental 93
 polynomial 104, 105
 pushing polynomials into 111-12, 121
 pushing terms into 114-15, 121
 setting-up 97, 105, 108, 118
 in YAPES 117, 178, 187
 data base theory 14, 15
 deciders, partial 293, 322
 decision procedures 83, 84, 88, 122-3
 decision rules, *see* rules, decision
 decision support systems 207, 208
 decision-trees 289, 382
 in ACLS 424, 428, 433
 construction of 306-8, 311-12, 316, 322-4, 376
 efficiency of 289, 290, 291, 293, 295-7, 298
 linearity of 289, 290, 291, 293, 294-5, 297, 298
 deduction facility 59, 61, 62
 definition facility 59, 60-1, 62
 discretion (legal concept of) 247
 domain closure 5, 14-15
 domains, disjoint 15-16
 domains, problem 322, 324

 ECG interpretation 435, 436
 see also arrhythmia-ECG knowledge bases;
 simulation algorithms, qualitative
 EG (magazine) 347, 348, 351
 entropy 296, 297, 298, 323, 324, 426-7
 environments, extensions of 70, 74, 75
 EqL 49, 51
 Eqlog 49, 52
 equality introduction, heuristics for 119, 120
 equality of terms 9, 13
 equations, conditional 21, 24, 39
 equations, directed 21, 23, 24
 equations, solution of 32-3
 equivalence, propositional 104, 116

- EVAL function 57, 59
 events 265, 266, 267, 268, 269, 285
 testing 265, 272, 273, 274
 training (learning) 265, 272, 273
 example efficiency 377
 example sets 292, 293, 322
 see also sets, training
 EXCEL 449, 450
 Expert-Ease 290, 319
 expert systems 169, 187
 for chess endgames 375-7, 379-83, 388-9
 front ends for 193, 204
 legal
 British Nationality Act 228-34, 235, 245
 as decision takers 212, 245
 as decision-taking aids 210-13, 238
 pension regulations 252-3
 Statutory Sick Pay 241, 249
 Supplementary Benefit 213-17, 235
 see also legislation
 shells 168, 172
 for weather forecasting, *see* WILLARD
- Fact system 335, 336
 False Alarm Ratio (FAR) 392, 403, 404
 FGL + LV 49, 51
 first-order theories (FOTs) 4, 8
 fixpoints 189
 FRANZ LISP 45
 functional dependencies 33-4
 functions
 built-in 45-6
 definition of 59, 85
 function symbols 85, 94, 169
- GEM 270, 272, 273-5, 283-4, 449, 450
 generalization, inductive 305
 Generic Associative Memory (GAM)
 devices 336
 goal rules 29
 goals, equationally satisfiable 41, 42
 goals, failure of 179-80, 182-3
 goals, logically satisfiable 42
 goals, unsatisfiable 47
 goal statements 169, 170
 ground terms 39, 47
- heart, qualitative model of 438-43, 453
 Herbrand interpretations 10
 Hintikka sets 9-12
 Horn clause logic 168, 172
 extended 173, 211, 218-19, 221-2, 223, 255
 Horn clauses 49, 52, 57, 58, 167, 169
 positive 60
 resolution of 66, 67
 hyps stacks 105, 106, 113, 116
- ID3 289, 297, 307, 322, 323, 376, 382
 comparison with RG 297, 298, 301, 302, 303
 identification in the limit 378
 implementation languages 172
 induction, grammatical 377, 378
 induction, probabilistic 328
 induction, rule 398
 induction, sequence 376-7, 378, 379
 induction, structured 290, 292, 303, 319, 324, 376
 inequalities, linear 88, 89
 inference, inductive 376
 inference, meta-level 167
 inference, non-monotonic 3, 259
 on partial models 12-17
 semantics for 5-9
 inference, object 167
 inference processes, slow 333, 334-5
 inferences, defeasible 3, 7, 9
 information 307, 308, 309, 310-11, 318
 INTERLISP 103
 interpretations 188, 189
 interpreter 39, 48, 167, 171-2, 175, 177
- justifications 174, 175-6
- KARDIO 452, 453
k-contextual algorithm 377-8, 381, 383
 Kling and Horwitz position 349, 350, 351, 361, 367, 371
 'distances' from 358-60
 knowledge acquisition 217, 289, 305, 379
 knowledge bases 168, 173, 179, 200-4
 knowledge representation 172, 187, 335
- lambda calculus 59, 62
 languages, regular 375, 377
 k-contextual 375, 377, 378
 k-reversible 377
 lattices 174, 177, 180, 188, 190
 LDS 211
 learning, inductive 449, 450
 learning methods, full memory
 incremental 263, 264
 with AQ 268-70
 experimental results 273-9
 summary of 279-87
 experiments to test 271-3

INDEX

- learning methods, partial memory
 - incremental 285
- learning methods, single-step 263, 274, 279, 280, 283, 285
- LEF (lexicographical evaluation functional) 268, 270
- legislation
 - ambiguities in 225, 227, 239-41, 251, 256
 - axiomatic models of 235-9, 246
 - conceptual models of 249, 250, 251
 - fragments of 234, 239, 246, 251
 - goal-directed formalization of 246-51, 256-7
 - 'normalized' form for 227
 - open-textured concepts in 227, 228, 245, 257
 - representation of, in logic 217-28
 - vagueness in 226, 227, 241-6, 251, 256, 257
 - see also* expert systems, legal
- LEGOL 221-2, 246
- lemma stacks 105, 106, 113, 116
- LFM 397, 398, 399, 410, 414, 421
- lifting mechanisms 395, 396, 416
- Limited Fine Mesh II Model, *see* LFM
- linear arithmetic 83, 84, 87-90
 - procedures 85
 - adequacy of 90-1, 122
 - efficiency of 120-2
 - integration into theorem provers 91-6
 - interface with rewriting 114-15
 - refinements to 96-100
- linearization 107-9
 - positive 109, 112, 113
- linearization hypotheses 90, 92, 99, 104, 105, 108
- linear rules 97, 112, 113
- LISP 21, 57, 58, 88, 106
 - viewed as a reduction system 59-60
 - see also* LOGLISP
- LISP-transforms 57
- literals 86, 169, 171, 174
 - rewriting 97, 98, 99
- LOGIC 57, 58, 60-2
- logic, deontic 223, 224
- logic, symbolic 218, 227, 256, 258
- LogiCalc 193-208
 - general behaviour of 195-200
 - potential areas for development 207
 - special features of 200-7
- logic programs, *see* programming, logic
- LOGLISP 48, 57, 58, 69, 70, 78
- mayfly nymphs 271, 272, 274-5, 276, 277, 279
- MDR (Manually Digitized Radar) blocks 396, 404
- micro-PROLOG 194, 196, 203, 205, 215, 234, 234
- modelling, qualitative 437
- models, financial planning 207
- models, partial 3, 5
 - conjectures on 3, 5-8, 17-18
 - extensions of 5, 6, 12, 13
 - Hintikka sets as 9-12
 - minimal 8, 9, 12
 - non-monotonic inference on 12-17
- models, relaxed 125, 126
- models of logic programs 188-9
- moisture convergence 394-5, 413, 416, 421
- MUGOL 375, 381, 382, 383
- multiplicands, key 106, 111, 112
- MYCIN 173, 211
- narrowing 24, 28, 31, 38, 41, 47, 49-52
 - conditional 28, 39, 41, 42
- naturals 88, 89, 90, 92
- negation 34-6, 52, 176, 220
 - as failure 214, 219-20, 221, 233, 239, 243, 259
- negative extension (NE) 12-13
- networks of cells 336-9
- nodes 290, 298
 - closure of 337
 - marked 323
 - non-terminal/internal 291, 306, 320
 - terminal/external 291, 320
- noughts and crosses 354-6
- OBJ2 22, 47
- obligation 223, 224, 249, 251
- OCCAM 76, 78
- parallel processing 47, 336
- paramodulation 48, 49
- PASCAL 158, 171, 270, 273
- path consistency 134, 135, 139-40
- pattern matching 31, 50
- Peano arithmetic 83, 84, 88
- pentominoes 356-8
- PoD (Probability of Detection) 391, 392, 403
- polynomials 89, 92, 93, 106-7, 109, 115
 - adding term to 109-10
 - available 111
 - converting terms to 107-11
 - inserting hypothesis into 110-11
 - mated 117, 118, 120
- MACLISP 103
- mates on a term 117, 120
- max-term 112, 113

- propagation of 93, 96, 97, 98, 120, 121
- pushing 93, 95, 97, 111-12, 121
- zero 107
- 'pop' algorithm 93, 94
- precedents 217, 226, 240, 251
- predicates 169, 171, 248, 249, 250
- probability distributions 145-9, 173-4, 429
- Probability of Detection, *see PoD*
- programming, functional 21, 22, 25-7, 47, 48, 57
 - see also* LISP; LOGLISP
- programming, logic 21, 22-3, 27-31, 32, 48, 169-71, 453
 - interactive 203
 - with uncertainties 187-90
 - see also* interpreters; PROLOG
- programming, relational 57, 67
- programs, rewrite 24, 26, 28-30
 - consistent 43
 - correctness of 37-45
 - features of 31-7
 - implementation of 45-7
- program verification 90-1, 121, 122, 123, 157, 160
- PROLOG 21, 27, 33, 57, 187, 443, 445
 - execution strategy of 234, 247
 - interpreters 167, 171-2, 177
 - meta-logical features of 171
 - as theorem prover 218, 219
 - type checker 181
 - versions of 173
 - see also* APES; micro-PROLOG; RG; YAPES
- Prolog-with-Equality 48
- proof theory 18
- proof trees 170, 171, 177, 179, 180
- propositional calculus 36, 39

- QLOG 48
- qualification problem 8-9
- Query-the-User 214
- queuing 46-7
- QUIN 270
- Qute 48, 49

- rationals 88, 89, 90
- RBT 149, 150, 151, 152, 153, 154
- realization of an expression 70
- reasoning, default 3, 7, 16-17, 259
- reasoning, non-monotonic, *see* inference, non-monotonic
- reasoning, plausible 169, 173, 177
- reasoning, uncertain 187
- recall, fast associative 334
- redexes 59, 62, 63, 64, 65
- reduction 59, 62, 64, 67
- relations, decomposable 130
- relations, definition of 60-1
- relationships, declared 202, 203, 204
- replication 199, 200, 201
- rewriter procedures 86, 92, 93, 94, 96, 104-6, 115-16
- rewrite systems 23, 25, 27
- RG 290, 291, 296, 297, 298-303
- RITE 45
- RuleFactory 319-31
 - display windows in 326-7
 - expert systems produced by 325-6
 - rule explanations in 324-5, 328-31
 - rule-testing in 324-5
 - subproblems in 322
- RuleMaster 391, 398, 402
- rule synthesis 291, 292
- rules, conditional 24, 52
- rules, decision 266
 - complexity of 273, 274, 283
 - induction of 268, 272, 273
 - see also* concept descriptions
- rules, default 4, 6
- rules, goal 29
- rules, linear 97, 112, 113
- rules, logic 24
- rules, rewrite 24, 25, 33, 50, 86, 92, 113
- rules, solution 30

- scheduling problems 203
- search trees 131, 132, 149, 154, 180
- selection criteria 307
 - investigations of 311-14, 315-17
 - original 308, 312, 314, 315, 316, 318
 - ratio 311, 312, 315, 316, 318
 - single-value 310, 312, 315, 316, 318
 - subset 309, 312, 315, 316, 317
- selectors 266
- self-commenting 320
- semantics (for logic programs) 48, 49, 188-90
- SETOF function 58, 61
- sets, Hintikka 9-12
- sets, residual 425, 426
- sets, test 428, 429
- sets, training 306, 307, 310, 312, 327, 423, 425
 - see also* example sets
- SIMPLE 194, 196, 201
- simplification of equations 24, 29, 31, 41, 42, 47, 51
- simplification of problems 132, 133, 142
- simplifiers 86, 92, 98, 159
- simulation algorithms, qualitative 443-7, 453
- SLOG 52

INDEX

- soybean disease diagnosis 271-2, 278, 279, 283, 284, 285
- specification languages 163, 164
- spreadsheets 193, 194, 195, 207
- Stanford Pascal Verifier (spv) 157, 158-60
- stars 266, 267, 268, 269, 270
- 'streams' 36-7
- string-searching algorithms 101, 121
- SUM (Syracuse Unification Machine) 70-8
- SUPER 62-8
- Supplementary Benefit system 213-17

- tableaux, analytic 9, 10, 18
- TABLOG 49, 51, 52
- tail biting 98, 99
- target reaching 204-5
- TAXMAN 248, 249
- termination 37-8, 50, 51, 52
- terms 86, 104, 169, 171
 - conglomerated 117
 - irreducible 39, 41, 42, 50, 51
 - isolated 117
 - ordering on 93
 - possibly numeric 109
 - pushing 114-15
- text specifications 325
- theorem provers 48, 159, 219, 248, 257
 - heuristic 83, 84
 - before incorporation of linear arithmetic 85-8
 - with linear arithmetic procedure 92-6, 120-2, 122-3
- theories, decidable 122
- theories, disjunctively complete 42-3
- thresholds 175, 176, 177, 190, 191
- thunderstorm forecasting, severe
 - government-issued (SELS) outlooks 391, 396-7, 402, 404-9
 - methods of 394-6
 - see also* WILLARD
- tree algorithm, maximum spanning 149
- triggering mechanisms 394, 413, 421

- type alists (TA) 104, 105, 108, 109, 116, 118
- type checkers 181, 183
- type sets 104, 108, 109

- uncertainties 187, 188, 190
- unification 31, 48, 49, 58, 66, 169-70
 - algorithms 66, 67, 70
 - computer architecture for 69-78
 - union function 26, 32-3
 - unique names hypothesis 13-14
- universes 10, 15, 180

- venting mechanisms 394, 395-6, 414, 416, 421
- verification conditions (v.c.s) 91, 92, 121, 159, 160
- VisiCalc 194
- VLSI 333, 341, 342
- Von Neumann (vn) architecture 336, 338

- Wafer Level Integration 337, 342
- weather forecasting, *see* thunderstorm forecasting, severe; WILLARD
- WILLARD 391, 392
 - analysis of test cases 411-21
 - decision rules in 401, 402
 - description of 397-402
 - FORTTRAN analysis routines callable by 397, 398, 402
 - summary of results 409-10
 - verification of 402, 404-9
- windows 195, 196, 197, 205, 206, 326-7

- YAPES 167-87, 190-1
 - facilities of 173-81
 - rationale behind 168-73
 - top level interpreter for 190-1
 - transcript of session 181-6
 - user interaction in 167, 177-81



