## Index

| $\begin{array}{cc} \wedge & 124 \\ \\|A\\| & 124 \end{array}$ |
| :---: |
| $\triangle 124$ |
| Ø 123 |
| $\equiv_{k-t t}^{p} \quad 98,99$ |
| $\geq{ }_{\text {lex }}^{\substack{\text {-tt }}} 82$ |
| $\cap 124$ |
| $\oplus 124$ |
| \|a| 123 |
|  |
|  |  |
|  |
| $\leq_{f} \quad 21-29,88-91,95,99,101,124$ |
| $\leq_{\gamma} 74,75,115$ |
|  |
| $\leq_{k-T}^{p} 100$ |
| $\leq_{k-t t}^{p} \quad 72,73,98,116$ |
| $\leq_{\text {lex }} 82$ |
| $\begin{aligned} & \leq_{m}^{p} \quad 2,4,5,8,29,30,46,61,66,73,74, \\ & 85,105-107,115,117 \end{aligned}$ |
| $\leq_{\text {poly-T }}^{e} 115$ |
|  |
| $\leq_{p t t}^{p} \quad 8,85,86,116$ |
| $\leq_{r} \quad 8,61,85,94,117,118,122$ |
| $\leq_{T}^{e} 1115$ |
| $\mathrm{S}_{T}^{p} \quad 2,8,27,42,44,67,68,76,99,115$ |
| $\leq_{T}^{s n} \quad 42,44,116$ |
| $\leq_{t t}^{p} \quad 8,61,62,65-70,94,108,116$ |
| ${ }_{-} 124$ |
| $\checkmark 124$ |
| $\checkmark 124$ |
| $\prec 124$ |
| $\cup 124$ |

Abadi 40
advice $19,20,24,27,28,30-36,39,52$,
$\quad 56,109$
$-\sim$ for nondeterministically selective
$\quad$ sets 32
$\sim$ for P-selective sets 17,20
$-\underset{\sim}{\sim}$ interpreter see interpreter,
$\quad$ advice
Abadi 40
dvice $19,20,24,27,28,30-36,39,52$,
56, 109
~ for nondeterministically selective
$\sim$ for P-selective sets 17,20
advice

- class of $\sim$ interpreters 31
- improvement below linear $\sim$ for recognition of P-selective sets 31
- length-bounded ~ 19
- linear ~ 24, 26, 30, 31,39
- logarithmic ~ 39
- lying ~ 33
- polynomial $\sim 19,39$
- quadratic $\sim 30$
- recursive ~ 39
- small ~ 3
- strong ~ 35-37

Agrawal 77, 113
algorithm $16,17,24,26,30,47,52,64$, $70,72,86,90,92-94$
$-\sim$ finding the king of a tournament 63

- deterministic polynomial-time $\sim \mathrm{v}$, $1,2,5,29,30,64-66,69,72,89$
- intelligent $\sim$ vi
- linear-exponential-time $\sim 27$
- nondeterministic polynomial-time ~ 14, 90, 93
- nondeterministic recursive $\sim 92$
- output of a polynomial-time $\sim \mathrm{v}$
- P-time decoding $\sim$ for advice 23
- polynomial-time membership $\sim 2$
- recursive $\sim$ v
- semi-membership $\sim \mathrm{s} \quad 2$
- smart ~ vi
- standard brute-force conversion of a nondeterministic $\sim$ to a deterministic ~ 26
- theory of semi-feasible $\sim$ s iii

Allender vii, viii, 58, 59
ambiguity

- polynomial ~ 119

Amir 59
analog

- complexity-theoretic $\sim \mathrm{v}, 1$

- ~ of functions computable via polynomial-time truth-table access to NP 68
- $\sim$ of languages $120,121,123$
- ~ of oracles 121
- ~ of P-selective sets 81
$-\sim$ of sets having interactive proofs 59
- $\sim$ of sets of simple organization 43
- ~ of sets reducible to P-sel 26
$-\sim$ of the form $\mathcal{C} /$ poly 34
- $\sim$ es in the extended low hierarchy 45
- ~es of nondeterministically selective sets 49
- ~es that are not subsets of P/poly 76
- ~es that lack hard P-selective sets 61
- advice ~ 19, 34
- advice upper bounds for reductions to selectivity $\sim$ es 22
- advice upper bounds for selectivity ~es 21
- arbitrary $\sim$ of selector functions 9
- classic low ~es 41
- collapse of $\sim$ es 12 , see collapse
- complement of a $\sim 11$
- complexity $\sim 3,8,16,19,41,61,62$, $79,116,117,119$
- complexity $\sim$ es near polynomial time 2
- degree of organizational simplicity of selectivity ~es 43
- $\mathrm{EL}_{\Delta_{k}^{p}} \sim \mathrm{es} 58$
- $\mathrm{EL}_{\Sigma_{k}^{p}} \sim$ es 58
- $\mathrm{EL}_{\Theta_{k}^{p}} \sim \mathrm{es} 58$
- equalities and inequalities of reduction and equivalence $\sim \mathrm{es}$ of P-selective sets 103
- equivalence $\sim 8,97,100,124$
- exponential-time complexity $\sim \mathrm{es}$ 16
- first two levels of the high hierarchy are well-known $\sim$ es 42
- function ~es 19, 119, see function, class of
- function analog of ~es 68
- hardness for complexity ~es 61
- high ~ 42
- inclusion properties of nondeterministic advice $\sim$ es 39
- incomparable ~es: P-sel and weakly-P-rankable 110
- $\mathrm{L}_{\Delta_{k}^{p}} \sim$ es 58
- length-based advice ~ 117
- low ~es 43
- lowness ~es 43
- $\mathrm{L}_{\Sigma_{k}^{p}} \sim \mathrm{es} 43,58$
- $\mathrm{L}_{\Theta_{k}^{p}} \sim \mathrm{es} 58$
- membership in nondeterministic $\sim$ es 80
- membership in the complexity $\sim \mathrm{P}$ 1
- nondeterministic function $\sim$ es 9
- nondeterministic selectivity $\sim$ es 9 , 81
- optimal lower bounds for most extended-lowness $\sim$ es 59
- reduction ~ 97
- reduction and equivalence $\sim$ es 94 , 95
- refined advice $\sim 20$
- refinement of multivalued nondeterministic function $\sim$ es 40
- relationships between nondeterministic selectivity $\sim \mathrm{es} 12$, 13
- relativizable $\sim 43$
- relativized $\Sigma_{k}^{p} \sim 43$
- selectivity $\sim \mathrm{es} 10$
- semi-recursive sets as a $\sim$ from recursive function theory v
- separation of reduction $\sim$ es from equivalence $\sim$ es 96
- set of equivalence $\sim$ es 7,124
- set-wise complements of a complexity $\sim 116$
- structure of polynomial-time complexity $\sim$ es 48
- $\Theta_{k}^{p} \sim \mathrm{es} 43$
- time-bounded $\sim 20$
- token-based advice $\sim 117$
classification
$-\sim$ of sets in NP using the low hierarchy 42
clique
- $q$-~ 63
closure
- ~ properties of P-sel 6
$-\sim$ under 2-ary connectives of P-sel, $\mathrm{NPSV}_{t}$-sel, and $\mathrm{NPMV}_{t}$-sel 84
$-\sim$ under bounded-truth-table reductions of a class 81

| ~ under combined self-reducibility and 1-truth-table reductions of P-sel 103 | - ~ of the polynomial hierarchy being a consequence of unique solutions for SAT 38 |
| :---: | :---: |
|  |  |
| ~ under complement of NPMV-se $15,82$ | - surprising $\sim$ of complexity classe 61 |
| $-\sim$ under complement of $\mathrm{NPMV}_{t}$-sel $11,15,34$ | - unexpected $\sim$ of complexity classes |
| under complement of NPSV-sel | collection |
| d $\mathrm{NPMV}_{t}$-sel | of strings $53,56,57$ |
| - $\sim$ under complement of P-sel 24, | commutativity 111,112 |
| 79, 81, 83 | comparability |
| - $\sim$ under conjunctive reductions of | - membership ~ 105, 113 |
| NP 79 | - $\mathcal{O}(\log n)$ membership $\sim 108$ |
| - ~ under connectives of P-sel 102 | compl |
| - ~ under connectives of selectivity | - ~ of a P-selective set $24,26,79$ |
| classes | f a set 12 |
| - $\sim$ under disjunctive reductions of NP 79 | - ~ of an NPSV-selective set 12 complementation |
| - ~ under intersection of P-sel 82 | - ~ and connectives 84 |
| $\sim$ under $k$-ary connectives of P-sel, | - closure under $\sim$ of NPMV-sel 82 |
| $\mathrm{NPSV}_{t}$-sel, and $\mathrm{NPMV}_{t}$-sel 84 $-\sim$ under many-one reductions of NP | - closure under $\sim$ of $\mathrm{NPMV}_{t}$-sel 11, 15 |
| $79$ | - closure under $\sim$ of $\mathrm{NPSV}_{t}$-sel and <br> $\mathrm{NPMV}_{t}$-sel 81 |
| $-\underset{\text { levels of the low hierarchy }}{ }$ | $\begin{aligned} & \text { - closure under } \sim \text { of P-sel } \quad 5,24,79 \\ & 81,83 \end{aligned}$ |
| P-sel 79 | completeness 61,117 |
|  | - ~ for NP |
| nondeterministic selectivity classes 83 | $-\sim$ for NP under many-one reductions 2 |
| $\sim$ under positive reductions of P-sel 103 | $-\sim$ for NP under Turing reductions 2 |
| ~ under positive Turing reductions | $\begin{array}{ll} -\leq_{m}^{p}-\sim \text { for UP } & 66 \\ -\leq_{T}^{s n}-\sim \text { for NP } & 42 \end{array}$ |
| of P-sel 79, 80 | - $\mathcal{C -} \sim 61,117$ |
| $\sim$ under reductions of P-sel 80,85 | - $\leq_{m}^{p}$ ~ 117 |
| $-\underset{79}{\sim}$ under Turing reductions of EXP | - $\mathcal{C}-\leq_{r}$ - $\sim 10117$ |
| - boolean $\sim$ of a complexity class 81 | - high hierarchy as a hierarchy of generalized $\sim$ notions 43 <br> - NP-~ 42,43 |
| - downward $\sim$ of P-selective sets 79 | complexity 8 |
| - downward $\sim$ under 1-truth-table reductions 88 | - $\sim$ in terms of deterministic time <br> - advice ~ 111 |
| - extension of $\sim$ to $\operatorname{NPSV}_{t}$-selectivity 103 | - arbitrary ~ 8, 17, 39 |
| - reduction | - capture of $\sim \mathrm{v}$ <br> - computational $\sim$ vii |
| - relativized world $\sim$, optimal for self-reducible P-selective sets 103 | - computational $\sim$ of a gappy left cut 31 |
| collapse | - computational $\sim$ of a P-selective set |
| $\sim$ of the boolean hierarchy 76 | 18 |
| - $\sim$ of the low hierarchy 48 | - computational $\sim$ of a tally set 17 |
| $\sim$ of the polynomial hierarchy vi, 2 , | - concept from computational $\sim$ vii |
| 10, 38, 40, 42-44, 54, 55, 57, 108, 121 | deterministic time $\sim$ |


| - left cuts capture the $\sim$ of real numbers v <br> - nonuniform $\sim 17$ | - transition ~ 97, 98 Crescenzi vii cut |
| :---: | :---: |
| - semi-membership $\sim 1,3$ <br> - types of $\sim \mathrm{v}$ | ```- computational complexity of a gappy left ~ 31``` |
| computability | - gappy left ~ 31,96,99 |
| - $\sim$ in deterministic polynomial time $119$ | - left $\sim$ s capture the complexity of reals v |
| $-\sim$ in $\mathrm{FP}_{t t}^{\mathrm{NP}} 70$ | - nonempty parts of a gappy left $\sim$ |
| $-\sim$ in polynomial time 120 | 31 |
| - deterministic polynomial-time $\sim$ | - standard left $\sim$ of real numbers 3 |
| $119$ | - time-bounded left $\sim s \quad 16$ |
| $- \text { easy } \sim 100$ | decidability 8 |
| $-$ | degree |
| - polynomial-time <br> - recursive ~ 31 | $-\sim$ in NP 8 |
| computation $19,20,33,97,116,121$ | - $\sim$ of organizational simplicity of selectivity classes 43 |
| - $\sim$ of the value of a circuit 18 | $-\leq_{m}^{p}-\sim 8$ |
| - accepting ~ 93 |  |
| - feasible $\sim 2$ | $-\leq_{r^{-}} \sim 8$ |
| - nondeterministic guess of $\mathrm{a} \sim 14$ | $-\leq_{T-\sim}^{p}$ - 8 |
| - polynomial-time $\sim 2$ | $-\overline{\leq}_{t t}^{p} \sim \sim 8$ |
| - semi-feasible $\sim$ v-vii, $1,2,16$ | - maximum out-~ 63 |
| - world of $\sim$ v | - node with maximum out-~ 76 |
| computers | - NP ~ 8 |
| - making $\sim$ smarter vi | - recursively enumerable $\sim$ s 15 |
| computing | - reducibility $\sim 8$ |
| - intuitive $\sim$ vi | - sets in an NP $\sim 8$ |
| coNE 8 | $\Delta_{0}^{p, A} 117$ |
| connection | $\Delta_{2}^{p} \quad 61,66,67,122$ |
| - structural ~ v | $\Delta_{k}^{p} \quad 43,117,118$ |
| connective | $\Delta_{k}^{p, A} \quad 45,117,118$ |
| $-\sim$ s and complementation 84 | diagonalization 96, 97, 99-102 |
| - almost-completely degenerate $\sim$ s | Díaz vii |
| $\text { - boolean } \sim \mathrm{s} \quad 79,8$ | domain |
|  | - ~ of an NPSV function 39 |
|  | DSPACE 118,121 |
| - completely degenerate $\sim s \quad 80,83,8$ <br> - degenerate $\sim$ s 84 | $\underset{121}{\text { DTIME }} 2,8,31,68,71,82,118,119,$ |
| - identity ~ 84 <br> - nondegenerate $\sim$ s 83,84 | Du vii |
| - under which $\sim$ s are P-selective sets | E 8, 22, 26, 27, 109, 115, 118 |
| closed 79 | $\mathrm{E}_{1-T}^{p}$ |
| coNP $12-16,20-22,24-26,32-34,37$, | $-\sim($ P-sel $) 95$ |
| $38,40,42,44,54-56,68,74-76,78,82$, | $\mathrm{E}_{1-t t}^{p}$ |
| $88,90,116,117,120,122$ | - ~ (P-sel) 95, 97 |
| - are nondeterministically selective | EATCS i |
| sets hard for $\sim 73$ | $\mathrm{E}_{b t t}^{p}$ |
| coNP/poly $21,33,34$ | $-\sim($ P-sel $)$ 97, 100 |
| containment | $\mathrm{E}_{k-T}^{p}$ |
| - nonuniform ~s 67 | $-\sim(\mathrm{P}-\mathrm{sel})$ 97, 100, 103 |
| coR 123 | $\mathrm{E}_{k-t}^{p}$ |
| count | $-\sim($ P-sel $) \quad 97,99,100,103$ |

Index

| $\begin{array}{ll}\mathrm{EL}_{\Delta_{k}^{p}}^{p} & 45,46,48,58,118 \\ \mathrm{EL}_{\Delta_{k}^{p}}^{W} & 48,118 \\ \end{array}$ | $-\sim$ computable by a deterministic polynomial-time Turing machine 119 |
| :---: | :---: |
| $\mathrm{ELH}^{k} 45,54,55,118$ | - $(A, k)$-sort $\sim 113$ |
| $\mathrm{EL}_{\Sigma_{k}^{p}} \quad 45-50,54,55,58,59,107,118$ | - advice $\sim 19,23$ |
| $\begin{aligned} & \mathrm{EL}_{\Theta_{k}^{p}}^{p} \quad 45,46,49,55,58,107,118 \\ & \text { van Emde Boas vii, } 103 \end{aligned}$ | - almost completely degenerate $\sim 80$ <br> - associative ~ 111 |
| enumerability see P-enumerability | - boolean $\sim 79,83$ |
| $\epsilon 123$ | - characteristic ~ 81, 84 |
| equality 43,68 | - class of $\sim$ S $9,19,117,119$ |
| - complete $\sim$ versus weak $\sim 16$ | - class of $\sim$ s computable via $\mathcal{O}(\log n)$ |
| - notion of $\sim$ for partial functions 16 | Turing queries to NP 68 |
| equivalence 81,99 | - class of $\sim$ s computable via truth-table |
| - Turing $\sim$ between tally sets and | access to NP 68 |
| P-selective sets 17,30 | - collection of $\sim$ s 20,117 |
| $\mathrm{E}_{T}^{p}$ | - completely degenerate $\sim 80$ |
| - ~(P-sel) 97, 99, 100 | - complexity-theoretic study of |
| $\mathrm{E}_{t t}^{p}$ | one-way $\sim$ s 16 |
| - ~(P-sel) 97, 100 | - computable $\sim 62,64,65$ |
| example $2,3,5,6,8,9,13-15,17,18$, | - degenerate $\sim 80$ |
| $21,41,43,46,48,58,61,71,74-76,79$, | - deterministic polynomial-time |
| 81, 82, 85, 90, 97, 105, 108, 109 | computable ~s 119 |
| - classic $\sim$ of P-selectivity 3 | - FPP-selector ~ 109 |
| - counter~ 50 | - general classes of $\sim$ s 16 |
| EXP $27,37,38,66,67,76,79,119$ | - logspace $\sim$ s 20 |
|  | - multivalued ~ 122 |
| $\mathcal{F}$-sel $\quad 9,119,120$ | - multivalued nondeterministic |
| fair-S(k) 106 | polynomial-time $\sim$ s 120 |
| fair-S( $n$ ) 106, 107 | - multivalued symmetric $\sim 10$ |
| feasibility | - nondegenerate boolean $\sim 84$ |
| - semi-~ vii, 1 | - nondeterministic selector $\sim 32$ |
| Feigenbaum 40 | - notion of equality for partial $\sim \mathrm{s} 16$ |
| FewP 68, 69, 119 | - NPMV ~ 10 |
| FEXP 82, 109 | - $\mathrm{NPMV}_{t} \sim 10$ |
| FEXP-sel 82 | - NPSV ~ 10 |
| flier | - NPSV-selector ~ 32 |
| - taking a $\sim$ vi | - $\mathrm{NPSV}_{t} \sim 10$ |
| formula | - P-selector ~ 1, 3-7, 21, 23, 25, 26, |
| - boolean ~s 35,36 | $28,31,32,35,49,63-65,85,88,89,92$, |
| - satisfiable $\sim$ s vi, $5,38,73$ | 94-96, 98, 99, 102, 111-113, 124 |
| Fortnow viii, 59, 76 | - partial $\sim 16$ |
| $\begin{aligned} & \mathrm{FP} \quad 9,10,12-15,32,68,70,71,77,88, \\ & \quad 96,111,112,115,119,121 \end{aligned}$ | - partial multivalued $\sim 9,10,122$ <br> - polynomial-time computable $\sim 7$, |
| - relativized $\sim 14$ | 65, 107 |
| $\mathrm{FP}^{\mathrm{NP}[\mathcal{O}(\log n)]} 68,70,71,77$ | - probabilistic selector $\sim 105,109$ |
| FPP 109, 113 | - ranking ~ 110 |
| $\mathrm{FP}_{t t}^{A} 70$ | - selector $\sim$ v, $7,10,32,53,57,81,90$, |
| $\mathrm{FP}_{t t}^{\mathrm{NP}} \quad 68,70,71,77$ | 92, 96, 98, 105-107, 109, 121 |
| $\mathrm{FP}^{X} \quad 96$ | - selector $\sim$ for $\mathrm{NPSV}_{t}$-sel sets 32 |
|  |  |
| $\begin{aligned} & \text { - dyadic rational } \sim 3 \\ & \text { function } \end{aligned}$ | $\begin{aligned} & \text { the arguments } 4 \\ &- \text { single-valued } \sim \end{aligned} \quad 10,56,120$ |



- single-valued deterministic
polynomial-time computable $\sim$
9
- single-valued nondeterministic
symmetric selector $\sim 4,22,28,34$,
96, 101
- total ~ 117, 119
    - total multivalued nondeterministic
polynomial-time $\sim 120$
- total recursive $\sim 96$
- total selector ~ 32
- total single-valued $\sim 119$
- total single-valued nondeterministic
polynomial-time ~ 120
- uncomputable $\sim 18$
Gabarró vii
Gasarch vii, 59, 113
gate 18
- and $\sim 18$
- exponentially many $\sim$ s 18
- not ~ 18
- or $\sim 18$
- polynomial number of $\sim$ s 18
Gavaldà 59
generalization 15, 105-110, 121
- ~s of P-selectivity 105
Gill 113
Goldsmith 15,113
de Graaf vii
guess
- nondeterministic ~ bits 62
path 53
Gundermann 76
hardness 61, 117
- $\leq_{t t^{-} \sim}^{p} \quad 66$
- coNP- $\leq_{m}^{p}$-~ 73
- NP-~ 61
- NP- $\leq_{1-t t}^{p}$ ~ 74
- NP- $\leq_{\gamma}-\sim 74$
- NP- $\leq_{t t^{-}}^{p} \sim 68$
- truth-table ~ for NP 67
~ for NP 67
Hartmanis 59, 76
- half ~ 40
Hemaspaandra

Hemaspaandra iii, iv, vii, viii, 15, 16, $39,40,58,59,76-78,102,103,112$, 113, see Hemachandra
Hempel vii, 113
HH $42,44,119$
hierarchy

- arithmetical $\sim 8,122$
- close connection of the extended low $\sim$ to the low $\sim 45$
- collapse of the boolean $\sim 76$
- collapse of the low $\sim 48$
- collapse of the polynomial $\sim$ vi, 2 , $10,40,42-44,54,55,57,108,121$
- decomposition of NP via the low $\sim s$ and high $\sim$ s 44
- extended low $\sim 118$
- high ~ 42
- Kleene ~ 122
- low ~ 41
- lowness ~ 43
- multiselectivity ~ 107
- polynomial $\sim$ and small circuits 35
- relativized polynomial ~ 117,122 , 123
$-\mathrm{S}(k) \sim 106$
Hoene vii, 16, 39, 40, 76-78, 103, 113
Hofmann viii
Holzwarth viii
Homan vii
Homer vii
$\mathrm{H}_{\Sigma_{k}^{p}} \quad 42,44,119$
immunity
- $\mathcal{C}$-~ 110
- P-~ 110,111
- P-sr-~ 111
- weakly-P-rankable-~ 111
incomparability
$-\sim$ of $\mathrm{E}_{T}^{p}(\mathrm{P}-$ sel $)$ and $\mathrm{R}_{b t t}^{p}(\mathrm{P}-$ sel $) \quad 100$
$-\sim$ of $\mathrm{E}_{T}^{p}(\mathrm{P}-\mathrm{sel})$ and $\mathrm{R}_{t t}^{b t t}(\mathrm{P}-\mathrm{sel}) \quad 100$
$-\sim$ of $\mathrm{E}_{t t}^{p}(\mathrm{P}-\mathrm{sel})$ and $\mathrm{R}_{b t t}^{p}(\mathrm{P}-\mathrm{sel}) \quad 100$
inequality 29,42
interpreter
- advice $\sim 20,24,31,34,35$
- advice $\sim$ for SAT 35-37
- class of advice $\sim$ s 31
- nondeterministic advice $\sim 24,26$, 28
- NP advice ~ 25, 26, 30
- P advice $\sim 30$
- recursive advice ~ 39
intuition vi
- skating on $\sim$ vi

| in 103 |
| :---: |
| Jenner 77 |
| Jiang vii, 58, 102, 112 |
| Jockusch 15, 16, 103 |
| Joseph 15, 16, 113 |
| $k$-walk $97-99$ |
| - self-avoiding $\sim 97$ |
| Kadin 76 |
| Kämper 40 |
| Karloff 59 |
| Karp 20, 35, 39, 40 |
| Karp-Lipton |
| - ~ Theorem 35 |
| - relativized version of the $\sim$ Theorem 38 |
| Kilian 40 |
| king |
| - ~ of a tournament 24 |
| Kleene 16 |
| - ~ hierarchy 122 |
| Ko vii, 16, 39, 58, 59, 75, 112 |
| Köbler 16, 40, 58, 59 |
| Kummer 77, 103,113 |
| Landau 39 |
| language see set |
| - tally $\sim$ see set, tally |
| $\mathrm{L}_{\Delta_{k}^{p}}$ 43-45, 48, 58 |
| $\mathrm{L}_{\Delta_{k}^{p}}^{W^{p}} \quad 48$ |
| Lemma |
| - Toda Ordering ~ 76 |
| - Toda's ~ 76 |
| length |
| - advice $\sim 34$ |
| - bit-~ 23 |
| $\begin{aligned} & -\quad \text { linear } \sim 19-22,26,28,30,39,105, \\ & \\ & \hline 112 \end{aligned}$ |
| $\begin{aligned} & \text { polynomial } \sim 19-24,27,32-40,49, \\ & 54,55,67,68,76,78,105,107-109, \\ & 120,121 \end{aligned}$ |
| - quadratic ~ 19, 20, 24, 39, 112 |
| LH 41, 42, 44, 46, 48, 57, 58, 119 |
| Lindner 39, 76 |
| linear 19 |
| Lipton $20,35,39,40$ |
| list |
| - query ~ 116 |
| $\mathrm{L}_{k}^{W} 119$ |
| $\mathrm{L}_{\mathrm{NP}} 41$ |
| logarithm |
| - implicit base of $\sim 23$ |
| Long 16, 58, 59 |

loop

- self ~s 63

Low
$-\sim(\mathcal{C}) 119$
$-\sim\left(\Sigma_{0}^{p}\right) \quad 41$
$-\sim\left(\Sigma_{1}^{p}\right) \quad 41$
$-\sim\left(\Sigma_{2}^{p}\right) \quad 41$
$-\sim\left(\Sigma_{3}^{p}\right) \quad 41$
lowness $\quad 41-43,45,46,55,58,59$
$-\sim$ of all four types of nondeterministically selective sets 58

- ~ of nondeterministically selective sets 49,58
- ~ of NP $\cap$ P-sel 48
- ~ of P-selective sets 46,49
- analysis in terms of $\sim 58$
- best currently known upper bounds for $\sim$ of selective sets 51
- best currently known upper bounds for extended $\sim$ of selective sets 50
- definition of $\sim 41$
- extended ~ 43,46-49,59
- extended $\sim$ of all four types of nondeterministically selective sets 58
- extended-~ bounds 50
- extended-~ structure of P-selective sets 48, 49
- extended-~ upper and lower bounds 46
- extended-~ upper bounds 55
- generalization of $\sim 45$
- more general $\sim$ result 40
- nontrivial lower bound on $\sim 46,48$
- refined $\sim 43$
- upper and lower bounds on $\sim 46$, 49
- upper and lower bounds on extended ~ 49
$\mathrm{L}_{\mathrm{P}} 41$
$\mathrm{L}_{\Sigma_{k}^{p}} \quad 41-45,47-49,51,54,55,57-59$, 107, 119
$\mathrm{L}_{\Theta_{k}^{p}} \quad 43-45,50,55,58$
Lund 59
machine $\quad 9,24,27,28,32,47,52,56$, $65,67,69,81,92,95,99,100,102,103$, 116, 118
- bottleneck ~s 39
- deterministic $f(n)$-space Turing $\sim$ 118
- deterministic $f(n)$-time Turing $\sim$ 118
- deterministic polynomial-time Turing ~ $2,47,88,106,118,119,123$
- enumeration of partial recursive $\sim s$ 31
- exponential-time $\sim 27$
- FewP ~ 68
- FP ~ 12
- $\mathrm{FP}_{t t}^{A} \sim 71$
- function-computing Turing $\sim 10$, 120
- nondeterministic polynomial-time function-computing Turing $\sim 10$
- nondeterministic polynomial-time Turing $\sim 10,11,14,29,38,47,50$, $55,62,65,69,90,109,115,120,121$
- NP ~ 53, 56, 67
- oracle $\sim 47,86$
$-\mathrm{P}^{A \oplus \mathrm{SAT}} \sim 47$
- polynomial-time oracle $\sim 29$
- polynomial-time Turing ~ 27,69
- probabilistic polynomial-time Turing ~ 123
- query-clocked ~ 100
- simulating $\sim 27$
- Turing ~ 5, 116
- Turing reduction ~ 94
- unambiguous polynomial-time Turing $\sim 67,123$
- unambiguous Turing ~ 67

Magklis viii
Mayer viii
McLaughlin 16
measure

- ~ of resource 19
- complexity ~s 107
measurement
- fine-grained $\sim$ of advice 20

Meyer 16
MinimumPath $62,65-67,69,70$
$\mathbb{N} \quad 124$
$\mathbb{N}^{+} \quad 124$
Naik vii, 16, 39, 40, 59, 76-78, 103
Nasipak vii, 39
nature

- nondeterministic $\sim$ of gamma reductions 90
NE 8, 119
NEXP 119
Nickelsen vii, viii, 113
Nisan 59
NNT 15
- implicitly membership-testable sets 2, 119
nonclosure
$-\sim$ of $\mathrm{EL}_{\Sigma_{k}^{p}}$ under many-one reductions 46
- $\sim$ of the extended low hierarchy 46
$-\sim$ under a function of P-sel 84
$-\sim$ under intersection for all selectivity classes 82
- ~ under $k$-ary connectives of NPSV-sel and NPMV-sel 84
$-\sim$ under nondegenerate connectives of NPSV-sel and NPMV-sel 84
- ~ under reductions of P-sel 85
$-\sim$ under union of selective sets 82
- simultaneous capture of $\sim$ under intersection for all versions of selectivity 82
nondeterminism vi, 39
- linear amount of $\sim 39$
- understanding of $\sim 9$
notation 123
notion
- ~ of being "easily $k$-countable" 113
$-\sim$ of equality for partial functions 16
- ~s closely related to P-selectivity 109
- $\sim$ s related to membership comparability 108
- advice ~ 35
- complexity-theoretic $\sim$ vii
- refinements of the $\sim$ of membership comparability 108
NP $\mathrm{v}, 2,3,5,8,9,11-16,20-22,25,26$, $29,30,32-59,61,66-72,74-79,81,82$, $88,90,91,94,103,105,107,108,111$, 112, 116, 117, 119-122
- complete for $\sim \mathrm{v}$
- completeness for $\sim$ under many-one reductions 2
- completeness for $\sim$ under Turing reductions 2
- relativized $\sim 42,43,47,48,119,120$

NP/poly 21, 33, 34
NPMV $10,11,15,16,34,39,54,74,91$, 92, 120
NPMV-sel $10,11,13,21,34,41,50,51$, $54,55,57,58,74,75,82-84,120$
$\mathrm{NPMV}_{t} 10-12,15,16,34,54,74,75$, 81, 90, 91, 120
NPMV $_{t}$-sel $11-13,21,34,41,50,51$, $54,55,57-59,74,75,81-84,90,120$
$\mathrm{NP}^{\mathrm{NP}} \quad 55,57,121$

| $\begin{aligned} & \text { NPSV } \quad 9,10,12,15,16,32,34,38,39, \\ & \quad 49,50,52,55,56,74,120 \end{aligned}$ | $\begin{array}{lc} -\mathrm{E}_{1-t t}^{p}(\sim) & 95,97 \\ -\mathrm{E}_{b t t}^{p}(\sim) & 97,100 \end{array}$ |
| :---: | :---: |
| NPSV-sel 10-13, 21, 32-34, 41, 49-51, | - $\mathrm{E}_{k-T}^{\text {btt }}(\sim)$ 97, 100, 103 |
| 54, 55, 57-59, 68, 74, 83, 84, 120 | - $\mathrm{E}_{k-t t}^{p}(\sim)$ 97, 99, 100,103 |
| $\mathrm{NPSV}_{t} 10,12-16,74,81,88,90,103$, | - $\mathrm{E}_{T}^{\mathcal{p}}(\sim)$ 97, 99, 100 |
| 120 | - $\mathrm{E}_{t t}^{p}(\sim) 97,100$ |
| $\mathrm{NPSV}_{t}$-sel $\quad 11-14,21,32,41,50,51,54$, | - $\mathrm{R}_{1-T}^{p}(\sim) 95$ |
| 57, 58, 68, 74, 81, 83, 84, 120 | - $\mathrm{R}_{1-t t}^{p}(\sim)$ 95, 96 |
| NT | - $\mathrm{R}_{2-t t}^{p-t}(\sim) 96$ |
| - near-testable sets 2,121 | - $\mathrm{R}_{b t t}^{p}(\sim) 97,100$ |
| NTIME 119, 121 | - relativized $\mathrm{R}_{k-t t}^{p}(\sim) 103$ |
|  | - $\mathrm{R}_{k-T}^{p}(\sim)$ 95, 97,99 |
| Ogihara vii, viii, 16, 39, 40, 59, 77, 78, | $-\mathrm{R}_{k-t t}^{p}(\sim) 95,97,99,103$ |
| 103, 113, see Ogiwara | - $\mathrm{R}_{n \mathcal{O}(1)-T}^{e}(\sim) 28$ |
| Ogiwara 76, 103, see Ogihara | - $\mathrm{R}_{\mathcal{O}(\log n)-T}^{p}(\sim) 95$ |
| - relativized ~ 48 | - $\mathrm{R}_{O\left(n^{k}\right)-T}^{e}(\sim) 27$ |
| oracle $12,14,27-29,41,43,47,52-54$, | - $\mathrm{R}_{T}^{p}(\sim) 35,97,100,102$ |
| $56,57,59,80,81,88,98-103,115,118$, | - $\mathrm{R}_{t t}^{p}(\sim) 95,97,99,100,102,108$ |
| 120,121,123 | P-sr 110, 111, 113 |
| - ~ query 5 | - the polynomial-time semi-rankable |
| - low sets as $\sim$ s 41 | sets 110 |
| NP ~ 71 | P/poly 21-24, 35-37, 39, 78, 105, 107, |
| - open $\sim$ questions 59 | 108 |
| ordering | Papadimitriou vii |
| - lexicographical $\sim 71,108,110$ | Parkins vii, 39 |
| - linear ~ 7,124 | Pasanen 16 |
| - linear $\sim$ of $\{1\}^{*} 6$ | Paterson 16 |
| - linear $\sim$ of $\Sigma^{*} 6$ | path 11, 12, 14, 53, 65, 81, 92, 93 |
| - linear $\sim$ of $\Sigma^{*} 6$ | - accepting $\sim 11,29,56,62,66-70$, |
| - partial $\sim 7$ | 90, 94, 120, 121, 123 |
| - partial ~ 7 | - accepting $\sim$ of a FewP machine 68 |
| output | - accepting $\sim$ of a function-computing |
| - ~ of a polynomial-time algorithm | machine 10, 120 |
| - linearly bounded $\sim$ of an advice function 19 | $\begin{aligned} & \text { - computation } \sim 14,33,56,62,66, \\ & \quad 69,70,87,109,121 \end{aligned}$ |
| - quadratically bounded $\sim$ of an advice | - directed $\sim 63,64,76$ |
| function 19 | - directed $\sim$ in a tournament 64 |
| Owings 113 | - guess bits of an accepting $\sim 70$ |
|  | - guessed $\sim 14$ |
| P v, 1-9, 12-16, 19-24, 26, 28-30, 32, | - guessed computation ~ 11 |
| 33, 35-39, 41-49, 54, 55, 58, 61, 62, | - minimum accepting $\sim$ of a nondeter- |
| $64-68,76-79,82,83,85,88,94,95$, | ministic Turing machine 62,65-67, |
| 103, 105-112, 115, 117, 118, 120-123 | 69, 70 |
| P-close 2, 49, 121 | - nondeterministic $\sim 53,54,57$ |
| P-enumerability 77 | - nondeterministic guess of a |
| P-mc 108 | computation $\sim 11,53$ |
| - ~ (const) 108 | - nondownward ~ 20 |
| - $\mathrm{R}_{\text {btt }}^{p}(\sim($ const $)) 108$ | - rejecting $\sim$ of a function-computing |
| P-sel $1-5,8,9,11-13,18,20-27,30,31$, | machine 10, 120 |
| $35,39,41,43,46-51,66-68,70,72,76$, | - rejecting $\sim$ s 66 |
| 77, 79, 81-85, 88, 94-96, 102, 103, 105, | - short $\sim$ s in a tournament 63 |
| 106, 110-112, 121 | - simulated $\sim 53$ |
| - $\mathrm{E}_{1-T}^{p}(\sim) 95$ | PH |

- polynomial hierarchy $15,35,37-40$, query $12,14,26-28,47,52-54,56,57$, $42,48,58,67,68,74-76,78,108,113, \quad 65,66,68-71,73,81,86,89-102,107$, 121
$\Pi_{k}^{p} \quad 37,38$
poly 19
Popeye 41
- ~ the Sailor Man 41
- cotton candy is low for $\sim 41$
- spinach is not low for $\sim 41$
power 41, 49, 94
- ~s of two 20
- distinguishing the $\sim$ of reductions v
- relative $\sim 2$
$108,115,116,118,121,123$
- answers to $\sim$ s 69, 70
- answers to $\sim s$ on the MinimumPath 70
- linear limit to number of $\sim s \quad 27$
- linear number of $\sim s$ by a Turing reduction 26
- membership ~ 70
- nonadaptive ~ 102
- oracle ~ 5
- polynomial number of $\sim s$ to a P-selective set 76
- separating the $\sim$ of reducibilities $2, \quad$ - possible answers to $\sim$ s 69 15
PP $\quad 28-30,46-49,55,75,109,121$
$\mathrm{PP} /$ poly 109
predecessor
- lexicographical $\sim 2$
preorder 7
procedure
- nondeterministic polynomial-time $\sim$ 91
program
- Selman's ~ 16
- Selman's structural ~ v
pronouncement 77
proof
- nonrelativizable $\sim 59$
- relativizable $\sim 46$
property
- closure ~ 84
- closure $\sim$ s of P-sel 6,79
- closure $\sim$ s of P-sel, NPSV ${ }_{t}$-sel, and NPMV $_{t}$-sel 84
PSPACE $37,58,59,66,67,75,88,105$, 109, 121
$\mathrm{P}^{W_{-s e l}} \quad 48$
$q \mathrm{P}$
- set of answers to $\sim 71$
- truth-table $\sim 70$

R 94

- random polynomial time 68,122 , 123
$\mathrm{R}_{1-T}^{p}$
$-\sim($ P-sel $) \quad 95$
$\mathrm{R}_{1-t t}^{p}$
- ~(P-sel) 95, 96
$\mathrm{R}_{2-t t}^{p}$
- ~(P-sel) 96

Ramachandran 59
range 101

- ~ of natural senses v

Ranjan 59
rank 110
rankability

- P-semi-~ 110
rational
- dyadic $\sim 3$
$\mathrm{R}_{b t t}^{p}$
$-\sim(\mathrm{P}-\mathrm{mc}($ const $)) 108$
- ~(P-sel) 97, 100
realization
$-\sim$ of an $\mathrm{FP}_{t t}^{\mathrm{NP}}$ function 77
recursiveness
- the quasipolynomial time sets 2,16 , 121
quadratic 19
quantification
- universal ~33
quantifier
- alternating $\sim$ s 43
- number of $\sim$ s needed to remove a set's ability to provide useful information 43
- polynomially bounded $\sim 9$
- unbounded $\sim 9$
, $6,82,83,85$
reducibility 8,117
- 1-truth-table $\sim$ to a P-selective set 88
- 2-disjunctive self-~ 5,118
- ~ degree 8
- disjunctive self-~ $5,38,118$
- disjunctive self- $\sim$ of SAT 35
- self-~ vi, 16, 74, 75, 79, 80, 88, 90, 103
- Turing ~ 26
- Turing self-~ 5, 74, 75, 88-92, 123


| Rohatgi 59 | - NPSV-~ $12,15,32,38$ |
| :---: | :---: |
| Rothe vii, 16, 58, 112 | - $\mathrm{NPSV}_{t}$ - $\sim 12,14-16,88,90,103$ |
| Royer 40 | - other types of $\sim$ than P-~ 102 |
| Rozenberg viii | - P-~ 1, 3-7, 9, 12, 14-16, 31, 49, 62, |
| $\mathrm{R}_{r}(\mathcal{C}) \quad 122$ | $64,68,74,82,88,102,103,105,109$, |
| $\mathrm{R}_{T}^{p}$ | 110 |
| - ~(P-sel) 35, 97, 100, 102 | - P-~ 1 |
| - ~(SPARSE) 35 | - probabilistic ~ 105, 109 |
| $\mathrm{R}_{t t}^{p}$ | - relationships between nondeterminis- |
| $-\sim(\mathrm{P}-\mathrm{sel}) \quad 95,97,99,100,102,108$ | tic $\sim$ classes 12 |
| - ~(TALLY) 35 | - study of nondeterministic $\sim 15$ |
| $\mathrm{S}(\sqrt{n}) 106$ | - understanding of $\sim 9$ - weak $\sim 105,112$ |
| S(2) 107 | $\text { selector } 52,64,81,97,99$ |
| $\mathrm{S}(k) 106$ | - ~ function see function, selector |
| $-\mathrm{R}_{m}^{p}(\sim) 106$ | - associative ~ 111-112 |
| $\mathrm{S}(\log n) 106$ | - commutative ~ ${ }^{\text {- }}$ - $111-112$ |
| ${ }_{S}(n) 106$ | $-\mathcal{F}-\sim \quad 9,119$ |
| $\underset{\mathrm{SNP} \text { cooNP }}{\mathrm{S}_{2}} 40,76,78,113,122$ | - more powerful ~s 109 |
| $\mathrm{S}_{2}^{\text {NP^coNP }} \quad 40,76,78,122$ | $\text { - NPMV-~ } 11,15,74,92$ |
| Salomaa viii | - - $^{\text {NPMV }}$ - ${ }^{\text {- }}$ ( $11,12,81,90$ |
| $\begin{aligned} & \text { SAT } \quad 5,9,14,15,35-39,45,47,54,68 \text {, } \\ & \quad 71-73,75,76,82,108,118 \end{aligned}$ | $\text { - NPSV-~ } 32,34,38,50,52,55,56$ |
| Schnorr 16 | - $\mathrm{NPSV}_{t^{-} \sim}^{\sim} 14,15$ |
| Schöning 15, 16, 58, 59 | - symmetric $\sim 4,86$ |
| - initial $\sim$ of a linear ordering 6 | - symmetric P-~ 100 |
| - initial $\sim$ of a polynomial-time computable linear ordering 6 | Selman v, vii, 1, 2, 4, 5, 15, 16, 39, 40, 59, 76-78, 103 |
| $-\quad \underset{6}{\text { initial }} \sim$ of a recursive linear ordering | sequence <br> - characteristic ~ 102 |
| selectivity $9,16,79,106$ | set |
| - $\sim$ and self-reducible sets 88 | $-\sim \mathrm{S} \leq_{r}$-equivalent to some set in $\mathcal{C}$ |
| - ~ via general functions 119 | 118 |
| - ( $A, k$ )-~ 113 | - $(a, b)_{p}$-recursive $\sim$ S 109 |
| - (i,j)-~ 106 | - advice complexity of the P-selective <br> ~s 111 |
| - associative ~ 111-112 | $\sim \mathrm{S} 111$ |
| - broadening of $\sim 9$ | - advice for P-selective $\sim$ s 20 |
| - commutative ~ 111-112 | - best currently known upper bound |
| - deterministic $\sim 90$ | for extended lowness of selective $\sim$ s |
| - $\mathcal{F}$-~ 9,119 | 50 |
| - FEXP-~ 109 | - best currently known upper bounds |
| - forms of ~ 105 | for lowness of selective $\sim$ s 51 |
| - four types of nondeterministic $\sim 15$ | - cheatable $\sim$ s 109,113 |
| - FPP-~ 109, 113 | - class containing Turing self-reducible |
| - $\mathrm{FP}_{t}^{L}$ - 88 | complete $\sim$ s 75 |
| - generalizations of $\sim 105$ | - closure properties of the P-selective |
| - multi~ 105, 106, 112, 113 | $\sim \mathrm{s} 6$ |
| - nondeterministic $\sim 9,80$ | - closure under complement of |
| - NP-~ 38 | NPMV-selective ~s 15 |
| - NP2V-~ 39 | - closure under complement of $\mathrm{NPMV}_{t}$ |
| - NPMV-~ $11,15,16,34,74,91$ | selective $\sim$ s 15 |
| - $\mathrm{NPMV}_{t-} \sim 11,12,15,16,74,75,90$, | - collection of $\sim \mathrm{s}$ 19, 20, 79, 81,117 |
| 91 | - complement of a $\sim 11$ |

- complement of an NPSV-selective ~ 12
- complete $\sim$ s 13,38
- complete characterization of P-selective $\sim$ s 6
- complete characterization of semi-recursive $\sim s \quad 6$
- computationally simple $\sim$ in a natural sense v
- $\Delta_{k}^{p}$ extended low $\sim \mathrm{s} 118$
- disjunctively self-reducible $\sim$ s 103 , 105, 118
- easily-countable $\sim$ s 108,109
- FPP-selective ~ 109
- implicitly membership-testable $\sim s$ $2,15,119$
- left cut ~28, see cut
- lowness for nondeterministically selective $\sim s \quad 49$
- lowness of P-selective $\sim$ s 46
- membership comparable $\sim s$ 107, 108
- membership complexity of $\sim \mathrm{s} \quad 1$
- near-testable $\sim$ s $2,15,108,109,121$
- nearly near-testable $\sim \mathrm{s} \quad 2,119$
- nondeterministic version of semifeasible $\sim$ vi
- nondeterministically selective $\sim s$ $10,61,67,73,90$
- nonempty finite sub~ of a P-selective set $21,24,25$
- nonempty finite sub~ of an NPMV-selective set 34
- nonrecursive $\sim \mathrm{v}$
- NP ~s 2
- NP- $\leq_{t t}^{p}$-hard $\sim 68$
- NP- $\leq_{T}^{p}$-complete $\sim 68$
- NP-complete $\sim 5,8,14,15,42,61$
- NPMV-selective ~s 34,54
- NPMV $_{t}$-selective $\sim \mathrm{s} 16,34,54$
- NPSV-selective ~s 16, 49
- NPSV $_{t}$-selective $\sim \mathrm{s} 14,16,88$
- oracle ~ 5
- P-close ~s 2, 15, 121
- P-enumerable $\sim 77$
- P-selective ~ v, 1-9, 17, 18, 20, 21, 23-32, 39, 46-49, 61-68, 70, 73, 76, 79-83, 85, 86, 88, 94-96, 98-103, 105-111, 113, 121
- P-selective $\sim \mathrm{S}$ whose intersection is not semi-recursive 82
- P-selective nonrecursive $\sim s \quad$ v
- P-semi-rankable ~s 105, 110
- P-superterse ~s 109
- P-verbose ~s 109
- polynomial-time semi-rankable $\sim s$ 110
- polynomial-time Turing equivalent
~s 8
- query ~s 69
- refinement of the semi-feasible $\sim \mathrm{s} \quad \mathrm{v}$
- self-reducible ~s 79, 88
- self-reducible P-selective $\sim 88$
- semi-feasible $\sim \mathrm{s} \quad \mathrm{v}, \mathrm{vi}, 1,121$
- semi-recursive $\sim \mathrm{s} \quad \mathrm{v}, 6,15,83,96$, 109, 122
- $\Sigma_{k}^{p}$ extended low $\sim s 118$
- sparse $\sim$ s 2,122
- standard left cut $\sim$ see cut
- superterse ~s 113
- tally $\sim 8,17$
- $\Theta_{k}^{p}$ extended low $\sim s 118$
- Turing self-reducible ~s 123
- verbose ~s 108
- weakly P-rankable ~s 110
- weakly P-selective ~s 105
- weakly-P-rankable ~s 110
- weakly-P-selective $\sim$ s 105
set-f $\quad 9-12,14,32-34,38,39,50,52$, $55,56,74,90,92,93,119,120,122$
setting
- satisfiability ~s 73

Sewelson 76
SH 106,107
Shamir 59
Sheu 58, 59
$\Sigma^{*} \quad 1,4-7,12,17-20,23,28,29,39,53$, $56,77,80,85,89,91,95,108,109,111$, 117, 124
$\Sigma_{0}^{p} \quad 41,122$
$\Sigma_{\Sigma_{1}^{p}}^{\Sigma^{p}} 41$
$\Sigma_{2}^{p} \quad 35-38,40,41,47,67,75,111$
$\Sigma_{3}^{2} 36,41$
$\Sigma_{k}^{p} 37,38,42,43,45,54,58,118,119$,
121, 122
$\Sigma_{k}^{p, A} 42,45,118,119,122,123$
simplicity 8

- lowness is a notion of organizational ~ 43
- organizational $\sim$ of selectivity classes 43
- structural ~8,9
simulation $12,27,53$
Sipser vii
Sivakumar vii, 76, 77
sorting

| $\sim$ of queries according to a selector | - $\sim$ of semi-feasible algorithms iii |
| :---: | :---: |
| $\begin{aligned} & 64,65,92,94-96,98,99,101,102 \\ &-(A, k)-\sim \\ & 113 \end{aligned}$ | $-\underset{\text { vii }}{\sim}$ of semi-feasible computation v , |
| space 19 | - advice $\sim 43$ |
| - deterministic $f(n) \sim 118$ | - basic lowness ~ 41 |
| - physical $\sim$ taken by a circuit 19 | - coding ~ 97 |
| - polynomial $\sim 121$ | - complexity $\sim 1,3,16,41,46,103$ |
| SPARSE 46, 48, 50, 107, 121, 122 | - computational complexity $\sim$ vii |
| - $\mathrm{R}_{T}^{p}(\sim) 35$ | - extended-lowness $\sim 46$ |
| spinach 41 | - lowness ~ 41, 43, 46 |
| - $\sim$ is not low for Popeye 41 | - P-selectivity ~ 68 |
| Stearns 76 | - recursive function $\sim \mathrm{v}, 2,58,103$ |
| step $26,31,32,51,53,56,57,62,64$, | - selectivity $\sim 3,105$ |
| 86, 87, 89, 91, 93, 98, 99, 116 | - tournament $\sim 63$ |
| - computation $\sim$ s 62 | $\Theta_{0}^{p, A} \quad 123$ |
| Stephan 77, 103, 113 | $\Theta_{k}^{p} \quad 43,118,123$ |
| Stol vii | $\Theta_{k}^{p, A} \quad 45,118,123$ |
| Stricker viii | Thierauf 16, 39, 40, 76-78, 103 |
| string | thresholds 106 |
| - advice $\sim$ 20, 25, 33 | time |
| - collection of $\sim$ s $21,57,116$ | - almost polynomial $\sim(A P T) ~ 2,16$ |
| - concatenation of $\sim$ s 17 | - co-nondeterministic polynomial $\sim$ |
| - easily decodable advice $\sim 23$ | 17 |
| $\begin{aligned} & - \text { evil } \sim 52 \\ & \text { study } 9 \end{aligned}$ | - deterministic "polynomial exponential" ~ 119 |
| - $\sim$ of associative selectivity 112 | - deterministic exponential $\sim 118$ |
| $-\sim \sim$ of nondeterministic selectivity | - deterministic $f(n) \sim 118$ |
| 15 | - deterministic polynomial $\sim 121$ |
| - ~ of P-selectivity 1,7 | - deterministic polynomial $\sim$ relative |
| - complexity-theoretic $\sim$ of one-way | an oracle 121 |
| nctions 16 | eterministic polynomial $\sim$ relative |
| - complexity-theoretic $\sim$ of semimembership complexity 1 | to an oracle with a bounded number of queries 121 |
|  | - exponential $\sim$ vi, 26 |
| TALLY 6, 30, 47, 122 | - linear ~ 98,100 |
| - $\mathrm{R}_{t t}^{p}(\sim) 35$ | - linear exponential ~ 27 |
| Tantau vii, 102, 103 | - nondeterministic "polynomial |
| tape 116 | exponential" ~ 119 |
| - oracle $\sim 116$ | - nondeterministic exponential $\sim 119$ |
| technique | - nondeterministic $f(n) \sim 121$ |
| - minimum path $\sim 61,62,68,75$ - parallel census $\sim 68$ | - nondeterministic polynomial $\sim 24$ $\quad 119,120$ |
| test 1,49 | - nondeterministic running $\sim 121$ |
| - classic simplicity $\sim 3$ | - probabilistic polynomial $\sim 121$ |
| testability | - quasipolynomial $\sim(q P)$ 2, 16, 121 |
| - near-~ 109, 113 | - random polynomial $\sim 122$ |
| Thakur vii | - unambiguous nondeterministic |
| Theorem | polynomial $\sim 123$ |
| - Karp-Lipton ~ 35 | Toda 75, 76 |
| - relativized version of the Karp- | - ~ Ordering Lemma 76 |
| Lipton ~ 38 | - ~'s Lemma 76 |
| theory | token |
| - ~ of positive relativization 59 | - advice $\sim 24-27,31,32,34,39,117$ |

Torán 77
Torenvliet iii, iv, viii, 39, 77, 103
tournament 63, 64, 76

- king of a $\sim 24$
tree 26
- ~ of possible queries 100
- self-reduction $\sim 90,91,93$
union $7,65,96,98,99,102,105,123$
UP $66,67,123$
variable $5,9,72,79,84$
- logical and of ~s 124
- logical or of $\sim \mathrm{s} 124$

Veltman viii
Verbeek vii
verboseness 113
Vereshchagin 58
verification

- polynomial-time $\sim$ of a certificate 33
Vyskoč 59

Wagner 76
Wang vii, 16, 39, 40, 76-78, 103, 113
Watanabe vii, 40, 58, 112
weakly- $\mathrm{FP}^{\Sigma_{2}^{p}}$-rankable 111
weakly-P-rankable 110

- the weakly P-rankable sets 110

Wechsung 40, 76, 77
West 76
worktape 10,120

- semi-infinite ~ 10,120
world
- real ~ 49
- relativized $\sim 46,48,49,76,103$, 108, 118, 119
Wössner viii
Young 15, 16, 113
Zaki vii, 16, 113
Zimand vii, 16, 59, 113
ZPP $37-40,67,68,74,78,108,122$, 123
ZPP ${ }^{\text {NP }} \quad 40,67,68,78,122$

