Richard A. Shore: Curriculum Vitae

Goldwin Smith Professor of Mathematics
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I. Education:

A. B. Summa cum laude in Mathematics, Harvard University, 1968.

Ph.D. in Mathematics, M.I.T., 1972.

II. Employment:

M.I.T., Teaching Assistant, 9/68-6/72.

University of Chicago, Instructor, 10/72-9/74.

Cornell University, Ass. Prof., 7/74-6/78; Assoc. Prof., 7/78-3/83; Prof., 4/83-6/13, Goldwin Smith Professor of Mathematics, 7/13-.

University of Illinois, Chicago, Assistant Professor, 1/77-8/77.

University of Connecticut, Storrs, Visiting Associate Professor, 9/79-12/79.

M.I.T., Visiting Associate Professor, 1/80-5/80.

Hebrew University of Jerusalem, Visiting Professor, 9/82-6/83.

University of Chicago, Visiting Professor, 2/87.

University of Sienna, Italy, Visiting Professor, 5/87.

MSRI, Berkeley, Member, 1989-1990.

Harvard University, Visiting Scholar, 1/97-6/97.

M.I.T., Visiting Scholar, 1/97-6/97.

National University of Singapore, Distinguished Visiting Professor, 12/99-1/00.

Harvard University, Visiting Scholar, 1/02-7/02.

IMS, National University of Singapore, member, 7/05.

M.I.T., Visiting Professor, 1/08-5/08.

University of Chicago, Visiting Professor, 02-03/09.

University of Siena, Italy, INDAM-GNSAGA Visiting Professor, 04-05/09.

National University of Singapore, Visiting Professor 06-07/11.

Isaac Newton Institute for Mathematical Sciences, Cambridge UK, Visting Fellow, 06/12.

III. Invited Talks:

Survey Lecture, Annual Meeting of the Assoc. for Symbolic Logic, Washington, D.C., January 1975.

20-minute talk, Special Session on Recursively Enumerable Sets and Degrees, AMS, Toronto, August 1976.

Survey Lecture, 2nd Symposium on Generalized Recursion Theory, Oslo, June 1977.

Hour lecture, Symposium in honor of S. Kleene, Madison, Wisconsin, June 1978.

20-minute talk at Special Session on Problems in logic arising in Mathematics, AMS, Providence, August 1978.

Principal speaker, Logic Colloquium '79, Leeds, England, August 1979.

Lecture series at UCLA including Hour lecture at UCLA Logic Meeting, January 1980.

20-minute talk at Special Session on Recursion Theory, AMS meeting, Kenosha, October 1980.

Hour Lecture, Annual Meeting of Assoc. for Symbolic Logic, San Francisco, January 1981.

Lecture Series, AMS Summer Research Institute in Recursion Theory, Ithaca, July 1982.

45-minute Lecture, International Congress of Mathematicians, Warsaw, August 1983.

John Gergen Memorial Lecture, Duke University, April 1984.

Hour Lecture, Third Biennial Greater Boston Logic Conference, M.I.T., April 1985.

Lecture Series (2 weeks), Nanjing University, Nanjing, China, May 1985.

Hour Lecture, Mid-Atlantic Logic Seminar, Ithaca, NY, October 1985.

Hour Lecture, Recursion Theory Week, Oberwolfach, March, 1989.

Hour Lecture, Fifth Biennial Greater Boston Logic Conference, M.I.T., April 1989.

20-minute Talk at Special Session on Recursion Theory, AMS, Chicago May, 1989.

30-minute Talk, Structures in Complexity Theory, Eugene, Oregon, June, 1989.

Hour Lecture, Workshop on Set Theory and the Continuum, MSRI, October, 1989.

20-minute Talk at the International Congress of Logic, Methodology and Philosophy of Science (ICLMPS), Uppsala, Sweden, August 1991.

Hour Lecture, Annual Meeting of Assoc. for Symbolic Logic, Durham NC, March 1992.

Hour Lecture, Latin American Logic Symposium, Bahia Blanca, Argentina, August, 1992.

20-minute Talk, Special Session on Pure and Applied Recursion Theory, AMS, Washington, April, 1993.

Hour lecture, The Sacks Symposium, Cambridge, MA, May 1993.

Plenary lecture, Logical Foundations of Computer Science, St. Petersburg, July, 1994.

Lecture series, Summer School in Recursion Theory and Complexity Theory, Kobe, Japan, July-August, 1994.

20-minute Talk, Special Session on Recursive and Feasible Mathematics, AMS, Orlando, January 1996.

Two lectures, Recursion Theory Week, Oberwolfach, February, 1996.

Hour Lecture, Annual Meeting of Assoc. for Symbolic Logic, Madison, March 1996.

Three Lecture Tutorial, Logic Colloquium '97, Leeds, July, 1997.

Hour Plenary Address, Workshop in Recursion Theory and Complexity Theory, Kazan, Russia, July, 1997.

Hour Lecture, Special Session on Computable Mathematics and its Applications, AMS, Baltimore, January 1998.

20-minute Talk, Special Session on Computability Theory, AMS, Gainesville, April, 1999.

25-minute Talk, Special Session on Computability Theory, ASL, San Diego, April, 1999.

Hour Lecture, Greater Boston Logic Conference, M.I.T., May 1999.

45-minute Talk, AMS Joint Summer Conference on Computability Theory and Applications, Boulder, June 1999.

Hour Lecture, International Congress of Logic, Methodology and Philosophy of Science (ICLMPS), Cracow, Poland, August 1999.

Speaker, Panel on The Prospects for Mathematical Logic in the 21st Century, ASL Annual Meeting, Urbana, June, 2000.

35-minute Talk, Special Session on Reverse Mathematics, ASL Annual Meeting, Philadelphia, March, 2001.

25-minute Talk, Special Session on Computability Theory with Applications, AMS, San Diego, January, 2002.

20-minute Talk, Special Session on Computability and Models, AMS, Baltimore, January, 2003.

Hour Lecture, Gathering in honor of Yiannis Moschovakis' 65th birthday, UCLA, January, 2003.

25-minute Talk, Special Session on Computability Theory and Effective Mathematics, ASL Annual Meeting, Chicago, June, 2003.

Hour Lecture, Logic Colloquium '03, Helsinki, August, 2003.

Three Lectures, Beijing Summer Workshop on Computation and Logic, Beijing, May 2004.

20-minute Talk, Special Session on Computability Theory and Applications, AMS, Evanston IL, October, 2004.

Hour Lecture, Midwest Model Theory Meeting (in honor of Carl Jockusch), UI, Urbana, December, 2004.

20-minute Talk, Special Session on Reverse Mathematics, AMS, Atlanta, January, 2005.

Retiring Presidential Address, ASL, Stanford, March 2005.

Hour Lecture, Computational Prospects of Infinity, IMS (NUS), Singapore, July, 2005.

Invited Lecture, MAMLS meeting in honor of Menachem Magidor's 60th Birthday, Irvine, February, 2006.

Plenary Lecture, SEALS, Gainesville FL, March 2006.

30-minute Talk, Special Session on Computability Theory in honor of Manuel Lerman's retirement, AMS, Storrs CT, October, 2006.

Hour Lecture, Logic, Computability and Randomness, Buenos Aires, January, 2007.

Hour Lecture, Model theory and computable model theory, UF Special Year in Logic, Gainesville FL, February 2007.

30-minute Talk, Algorithmic-Logical Theory of Infinite Structures, Dagstuhl, October, 2007.

Hour Lecture, Effective Mathematics of the Uncountable, New York NY, August 2008.

Hour Lecture, Midwest Computability Seminar, Chicago, February, 2009.

40-minute Talk, Special Session on Relative Computability, CiE, Heidelberg, July, 2009.

Gödel Lecture, Logic Colloquium '09, ASL, Sofia, August, 2009.

30-minute Talk, Reverse Mathematics: Foundations and Applications, Chicago, November 2009.

40-minute talk, Workshop on Computability Theory 2010, Paris, July, 2010.

20-minute Talk, Special Session on Computability and Its Applications, AMS, Notre Dame, November 2010.

30-minute talk, Special session, Definability throughout Mathematical Logic in honor of Leo Harrington, ASL North American Annual Meeting, Berkeley, March 2011.

Hour Lecture, Computability Theory and Applications, A Meeting in Honor of Robert I. Soare, Chicago, May 2011.

30-minute talk, Ramsey Theory in Logic, Combinatorics and Complexity, Bertinoro, Italy, May, 2011.

Short Course, The structure of the Turing degrees, Asian Initiative for Infinity (AII) Graduate Summer School, Singapore, June 2011.

Hour Lecture, Reverse Mathematics Workshop, Chicago, September, 2011.

Hour Lecture, Degrees and Randomness, A meeting in honor of Klaus Ambos-Spies on the occasion of his 60th birthday, University of Heidelberg, February, 2012.

Lead Lecture, Computability Theory, Mathematisches Forschungsinstitut Oberwolfach, February, 2012.

20-minute Talk, Special Session on Computable Mathematics (in honor of Alan Turing), AMS, Washington DC, March 2012.

30-minute talk, The Incomputable, The Royal Society, Chicheley Hall, Newport Pagnell UK, June 2012.

40-minute Talk, Special Session in Honor of Anil Nerode, LFCS, San Diego, January 2013.

20-minute Talk, Special Session on Effective Algebra and Model Theory, AMS, San Diego, January, 2013.

45-minute Talk, Special Session on Recursion and Definability, AMS, Boston, April, 2013.

40-minute Talk, Special Session on Computable Structure Theory and Computable Model Theory, ASL, Waterloo, May 2013.

Also colloquia and seminar talks at many universities. Has been an invited participant at other conferences (Oberwolfach, Dagsthul, Banff, Aim, etc.) and chaired sessions of invited talks at meetings of the AMS, ASL, CiE, ICLMPS, etc.

IV. Awards and Grants:

Gödel Lecturer, Association for Symbolic Logic, 2009.

Fellow of the American Mathematical Society, 2013.

Goldwin Smith Professor of Mathmatics, 2013.

NSF Summer Research Grants 1973- .

Research Grant, NSF, U.S.-Greece Cooperative Science Program, 1981-85.

Research Grant, NSF, U.S.-Italy Cooperative Research Program, 1986-89.

Research Grant: U.S.-Israel Binational Science Foundation 1986-90.

NSF grant "Support of Latin American participation in the Year in Mathematical Logic at MSRI" (Science in Developing Countries Program) 1989-90 (PI).

Research Grant, NSF: U. S.-New Zealand Cooperative Research Program, 1991-95.

Logical Methods in Mathematics and Computer Science: A symposium in Honor of Anil Nerode's Sixtieth Birthday, NSF, Special Projects, 1992 (PI).

Latin American Logic Symp., NSF, Science in Developing Countries Program, 1992 (PI).

Research Grant, NSF: U. S.-New Zealand Cooperative Research Program, 1997-00 (PI).

NSF Grants for student support, 1999-2001.

Templeton Foundation, sabbatical support, 2009-2010.

V. Editorial Boards:

Consulting Editor, *Journal of Symbolic Logic*, 1980-1983.

Editor, *Journal of Symbolic Logic*, 1984-93.

Coordinator of Editorial Board, *Journal of Symbolic Logic,* 1989-91.

Managing Editor, *Bulletin of Symbolic Logic*, 1993-2000 .

Editor, *Studies in Logic and the Foundations of Mathematics*, North-Holland, 1996-2007.

Publisher, Association for Symbolic Logic, 2008-.

VI. Organizing and Program Committees:

Organizing committee (co-chair), AMS Summer Research Institute in Recursion Theory, 1982.

Program Committee (chair), Annual Meeting of the Assoc. for Symbolic Logic, 1988-89.

Organizing Committee, Logic Year at MSRI, Berkeley, CA, 1989-90.

Organizing Committee, Third Logical Biennial, Bulgaria, June, 1990.

Organizing Committee, Symposium on Logical Methods in Mathematics and Computer Science: A symposium in Honor of Anil Nerode's Sixtieth Birthday, Ithaca, NY, June 1991.

Organizing Committee, Latin American Logic Symposium, Bahia Blanca, Argentina, July 1992.

Program Committee, Logic Colloquium '95, Haifa, Israel, August, 1995.

Co-chair, Special session on computability theory, Logic Colloquium '98, Prague, August 1998.

Co-chair, AMS Joint Summer Conference on Computability Theory and Applications, June 1999.

Program Committee, ASL Annual Meeting, Philadelphia, 2001.

Organizing Committee, Logic in Computer Science, 2003-4.

Program Committee, TAMC 2006 (Theory and Applications of Models of Computation 2006), Chinese Academy of Sciences, Beijing, May, 2006.

Program Committee, Logic Colloquium '06, Nijmegen, Netherlands, July, 2006.

Organizing Committee, Computability, Reverse Mathematics and Combinatorics, BIRS, Banf, December, 2008.

Program Committee, Algebra and Mathematical Logic: Theory and Applications, Kazan, June 2014.

VII. Other Professional Activities:

Member of the American Mathematical Society, the Association for Symbolic Logic, Association for Computing Machinery, SIGACT, $\phi\beta\kappa$ and $\Sigma\chi$.

Refereeing and reviewing for the National Science Foundation, the National Research Council, the Natural Sciences and Engineering Research Council of Canada, The Royal Society (U.K.), the U. S.-Israel Binational Science Foundation, the New Zealand Mathematical Society Research Awards Program, the International Science Foundation, AMS-NSA, Simons Foundation as well as other organizations in Austria, Canada, England, E. U., New Zealand, Singapore and various journals.

Outside thesis examiner, U. Toronto, U. Chicago and U. Heidelberg.

Member of Review Panels for NSF Program in Foundations and Logic.

Association for Symbolic Logic: Council of the Association for Symbolic Logic, 1984-; President 2001-04; Publisher, 2008-; committee on reviews 1975-76; Chairman, Nominating Committee 1989, 2006; member 1994, 2009, 2012, 2013; Chairman, Standing Committee on Meetings, 1992-3; Publications Committee, 1994-; Chairman, Committee on Electronic Publication, 1997-2000, 2004-; Chairman, Committee on Revising the Math. Reviews Subject Index in Logic, 1997; Member or chairman of various other ad-hoc committees over the years.

Project Euclid, Board Member, 2002-.

VIII. Ph.D. Theses Directed:

1. David A. Odell, Trace Constructions in α-Recursion Theory (1983). (Now at Insureware Pty. Ltd., Melbourne, Australia.)

2. Christine A. Haught, Turing and Truth-table Degrees of 1-Generic and Recursively Enumerable Sets (1985). (NSF Postdoctoral Fellow. Now Associate Professor, Loyola University, Chicago IL.)

3. Mark F. Simpson, Arithmetic Degrees: Initial Segments, $\omega - REA$ Operators and the ω-jump (1985). (Now President and Chief Executive Officer of Triveni Digital.)

4. Steven Kautz, Degrees of Random Sets (1991). (Now Senior Lecturer, Computer Science Department, Iowa State University.)

5. Yue Yang, Priority Arguments and Reverse Mathematics (1992). (Now Associate Professor, National University of Singapore.)

6. David Reed Solomon, The Reverse Mathematics of Ordered Groups (1998). (NSF Postdoctoral Fellow. Now Associate Professor, University of Connecticut, Storrs.)

7. Denis Hirschfeldt, Degree Spectra of Relations on Computable Structures (1999). (Sacks Prize Winner. Now Professor, University of Chicago.)

8. Walker White, Characterizations for Computable Structures (2000). (Now Director of the Game Design Initiative at Cornell, Computer Science Department, Cornell University.)

9. Yuval Gabay, Double Jump Inversions and Strong Minimal Covers in the Turing Degrees (2004). (Now working in industry in Israel.)

10. Noam Greenberg, The Role of True Finiteness in the Admissible Recursively Enumerable Degrees (2004). (Rutherford Discovery Fellow 2011-15; Turing Research Fellow 2012-15; Now Associate Professor, Victoria University, Wellington, New Zealand.)

11. Antonio Montalbán, Beyond the Arithmetic (2005). (Sacks Prize Winner. AMS Centennial Fellow, Packard Fellow. Now Associate Professor, University of California, Berkeley.)

12. Wojciech Tomasz Moczydlowski, Investigations on Sets and Types (2007), secondary advisor; primary: Robert Constable, Computer Science. (Sacks Prize Winner, now at Google).

13. Michael O'Connor, Using Automata to Investigate Intuitionistic Propositional Logic (2008). (Now at Jane Capital, New York NY.)

14. Paul Shafer, On the Complexity of Mathematical Problems: Medvedev Degrees and Reverse Mathematics (2011). (Now Postdoctoral Fellow, Department of Mathematics, Universiteit Gent.)

15. Mingzhong Cai, Elements of Classical Recursion Theory: Degree-Theoretic Properties and Combinatorial Properties (2011). (Sacks Prize winner. Now Van Vleck Visiting Assistant Professor, U. Wisc. Madison.)

IX. Postdoctoral fellows sponsored (Ph.D. institution):

1. Klaus Ambos-Spies (University of Munich), 1980-81. Now Professor and Head, Workgroup Mathematical Logic and Theoretical Computer Science, University of Heidelberg.

2. Dong-Ping Yang (Academica Sinica), Distinguished Scholar Exchange Program of the Committee for Scholarly Communications with the PRC, 1981-82. Now retired from Academica Sinica, Beijing.

3. Peter Fejer (University of Chicago), NSF postdoctoral fellow, 1981-83. Now Professor and Chair, Department of Computer Science, University of Massachusetts at Boston.

4. Robert Lubarsky (M.I.T.), NSF postdoctoral fellow, 1984-87. Now, Instructor, Dept. of Mathematical Sciences, Florida Atlantic University .

5. Paul Fischer (University of Bielfeld), 1986-87. Now Associate Professor, Computer Science and Engineering, Technical University of Denmark.

6. Peter Cholak (University of Wisconsin), NSF postdoctoral fellow, 1993-94. Now Professor Department of Mathematics, University of Notre Dame.

7. Yufei Sui (Academica Sinica), 1993.

8. André Nies (University of Heidelberg), 1994. Now Professor, Department of Computer Science, University of Auckland

9. Russell Miller (University of Chicago), NSF VIGRE postdoctoral fellow, 2000-03. Now Associate Professor, Department of Mathematics, Queens College - City University of New York.

10. Barbara Csima (University of Chicago), H.C. Wang Assistantt Professor, 2003-05. Now Associate Professor, Department of Pure Mathematics, University of Waterloo.

11. Bjørn Kjos-Hanssen (University of California, Berkeley), 2006-07. Now Associate Professor, University of Hawaii at Manoa.

12. Francois Dorais (Dartmouth), 2007-08. Now John Wesley Young Research Instructor, Department of Mathematics, Dartmouth College.

X. Publications:

1. On large cardinals and partition relations, *Journal of Symbolic Logic* **36** (1971), 305-308 (with E.M. Kleinberg).

2. Weak compactness and square bracket partition relations, *Journal of Symbolic Logic* **37** (1972), 673-676 (with E.M. Kleinberg).

3. Square bracket partition relations in L, *Fundamenta Mathematica* **34** (1974), 101-106.

4. Minimal α-degrees, *Annals of Mathematical Logic* **4** (1972), 383-414.

5. Cohesive sets: countable and uncountable, *Proceedings of the American Mathematical Society* **44** (1974), 442-445.

6. Σ_n sets which are Δ_n-incomparable (uniformly), *Journal of Symbolic Logic* **39** (1974), 295-304.

7. Splitting an α-recursively enumerable set, *Transactions of the American Mathematical Society* **204** (1975), 65-77.

8. The recursively enumerable α-degrees are dense, *Annals of Mathematical Logic* **9** (1976), 123-155.

9. The irregular and non-hyperregular α-r. e. degrees, *Israel Journal of Mathematics* **22** (1975), 28-41.

10. On the jump of an α-recursively enumerable set, *Transactions of the American Mathematical Society* **217** (1976), 351-363.

11. Types of simple α-recursively enumerable sets, *Journal of Symbolic Logic* **41** (1976), 681-693 (with A. Leggett).

12. α-Recursion theory, in *Handbook of Mathematical Logic*, J. Barwise ed., North-Holland, 1977, 653-680.

13. Determining automorphisms of the recursively enumerable sets, *Proceedings of the American Mathematical Society* **65** (1977), 318-325.

14. Controlling the dependence degree of a recursively enumerable vector space, *Journal of Symbolic Logic* **43** (1978), 13-22.

15. Some more minimal pairs of α-recursively enumerable degrees, *Zeitschrift fur Mathematische Logik und Grundlagen der Mathematik* **24** (1978), 409-418.

16. Nowhere simple sets and the lattice of recursively enumerable sets, *Journal of Symbolic Logic* **43** (1978), 322-330.

17. On the $\forall\exists$-sentences of α-recursion theory, in *Generalized Recursion Theory II*, Fenstad, Gandy and Sacks, eds., North-Holland 1978, 331-354.

18. r-Maximal major subsets, *Israel Journal of Mathematics* **31** (1978), 1-18 (with M. Lerman and R.I. Soare).

19. Second order logic and first order theories of reducibility orderings in *The Kleene Symposium*, J. Barwise, H.J. Keisler and K. Kunen, eds., North- Holland, 1980, 181-200 (with A. Nerode).

20. Reducibility orderings: theories, definability and automorphisms, *Annals of Mathematical Logic* **18** (1980), 61-89 (with A. Nerode).

21. The homogeneity conjecture, *Proceedings of the National Academy of Sciences* **76** (1979), 4218-4219.

22. On homogeneity and definability in the first order theory of the Turing degrees, *Journal of Symbolic Logic* **47** (1982), 8-16.

23. $\mathcal{L}^*(K)$ and other lattices of recursively enumerable sets, *Proceedings of the American Mathematical Society* **80** (1980), 143-146.

24. Some constructions in α-recursion theory, in *Recursion Theory: Its Generalizations and Applications*, F.R. Drake and S.J. Wainer, eds., London Mathematical Society Lecture Notes Series, no. 45, Cambridge University Press, Cambridge, England, 1980, 158-170.

25. The theory of the degrees below $0'$, *Journal of the London Mathematical Society* **24** (1981), 1-14.

26. The elementary theory of the recursively enumerable degrees is not $\aleph_0$-categorical, *Advances in Mathematics* **53** (1984), 301-320 (with M. Lerman and R.I. Soare).

27. Splitting properties and jump classes, *Israel Journal of Mathematics* **39** (1981), 210-224 (with W. Maass and M. Stob).

28. Definable degrees and automorphisms of $\mathcal{D}$, *Bulletin of the American Mathematical Society (NS)* **4** (1981), 97-100 (with L. Harrington).

29. The degrees of unsolvability: global results, in *Logic Year 1980-81: The University of Connecticut*, M. Lerman, J. Schmerl and R. Soare, eds., Springer- Verlag, 1981, 283-301.

30. Finitely generated codings and the degrees r. e. in a degree **d**, *Proceedings of the American Mathematical Society* **84** (1982), 256-263.

31. The Turing and truth-table degrees are not elementarily equivalent, in *Logic Colloquium 1980*, D. van Dalen, D. Lascar and T.J. Smiley, eds., North-Holland, Amsterdam 1982, 231-237.

32. An algebraic decomposition of the recursively enumerable degrees and the coincidence of several degree classes with the promptly simple degrees, *Transactions of the American Mathematical Society* **281** (1984), 109-128 (with K. Ambos-Spies, C. Jockusch and R. Soare).

33. Pseudo-jump operators I: the r. e. case, *Transactions of the American Mathematical Society* **275** (1983), 599-610 (with C. Jockusch).

34. Pseudo-jump operators II: transfinite iterations hierarchies and minimal covers, *Journal of Symbolic Logic* **49** (1984), 1205-1236 (with C. Jockusch).

35. The arithmetic and Turing degrees are not elementarily equivalent$^{\underline{invariants}}$, *Archiv fur Mathematische Logik und Grundlagenforschung* **24** (1984), 137-139.

36. The degrees of unsolvability: the ordering of functions by relative computability, in *Proceedings* of the *International Congress of Mathematicians (Warsaw) 1983*, PWN-Polish Scientific Publishers, Warsaw 1984, Vol. 1, 337-346.

37. *Recursion Theory, Proceedings of the Symposia in Pure Mathematics*, Vol. 42 (Proceedings of the AMS-ASL Summer Institute on Recursion Theory, Cornell, 1982), American Mathematical Society, Providence, R.I., 1985 (edited with A. Nerode).

38. The structure of the degrees of unsolvability, in *Recursion Theory, Proceedings of the Symposia in Pure Mathematics* **42**, A. Nerode and R.A. Shore, eds., American Mathematical Society,Providence, R.I., 1985, 33-51.

39. REA operators, r. e. degrees and minimal covers, in Recursion *Theory, Proceedings of the Symposia in Pure Mathematics* **42**, A. Nerode and R.A. Shore, eds., American Mathematical Society,Providence, R.I., 1985, 3-11 (with C. Jockusch).

40. Embeddings and extensions of embeddings in the *r.e.* tt and wtt degrees, in *Recursion Theory Week: Proceedings, Oberwolfach 1984*, H.D. Ebbinghaus, G.H. Müller and G.E. Sacks, eds., Springer-Verlag, Berlin, 1985, 121-140 (with P. Fejer).

41. Recursive limits on the Hahn-Banach theorem, *Contemporary Mathematics* **39** (1985), 85-91 (with A. Nerode and G. Metakides).

42. Initial segments of the Turing degrees of size $\aleph_1$, *Israel Journal of Mathematics* **55** (1986), 1-51 (with U. Abraham).

43. The degrees of constructibility of Cohen reals, *Proceedings of the London Mathematical Society (3)* **53** (1986), 193-208 (with U. Abraham).

44. Infima of recursively enumerable truth table degrees, *Notre Dame Journal of Formal Logic* **29** (1988), 420-437 (with P. Fejer).

45. A non-inversion theorem for the jump operator, *Annals of Pure and Applied Logic* **40** (1988), 277-303.

46. Decidability and invariant classes for degree structures, *Transactions of the American Mathematical Society* **310** (1988), 669-692 (with M. Lerman).

47. Defining jump classes in the degrees below $0'$, *Proceedings of the American Mathematical Society* **104** (1988), 287-292.

48. Initial segments of the degrees of constructibility, *Israel Journal of Mathematics, Israel Journal of Mathematics* **63** (1988), 149-177 (with M. Groszek).

49. The $p-T$-degrees of the recursive sets: lattice embeddings, extension of embeddings and the two quantifier theory (extended abstract), in *Proceedings: Structures in Complexity Theory,* 4^{th} *Annual Conference,* Comp. Soc. IEEE, 1989 (with T. Slaman).

50. A direct construction of a minimal recursively enumerable truth-table degree, in *Recursion Theory Week, Proceedings Oberwolfach 1989*, K. Ambos-Spies, G. H. Muller and G. E. Sacks, eds. Springer-Verlag, *LNMS* **1432** (1990), 187-204 (with P. Fejer).

51. Undecidability and initial segments of the (r. e.) tt-degrees, *Journal of Symbolic Logic* **55** (1990), 987-1006 (with C. Haught).

52. Working below a low_2 recursively enumerable degrees, *Archive for Mathematical Logic* **29** (1990), 201-211 (with T. Slaman).

53. Undecidability and initial segments of the wtt-degrees below $\mathbf{0}'$, in *Recursion Theory Week, Proceedings Oberwolfach 1989*, K. Ambos-Spies, G. H. Muller and G. E. Sacks, eds. Springer-Verlag, *LNMS* **1432** (1990), 223-244 (with C. Haught).

54. Global properties of local structures of degrees, *Bul. U. Mat. Ital.* **7** (1991), 97-120 (with G. Odifreddi).

55. On the strength of König's duality theorem for infinite bipartite graphs, *Journal of Combinatorial Theory (B)* **54** (1992), 257-290 (with R. Aharoni and M. Magidor).

56. The $p-T$-degrees of the recursive sets: lattice embeddings, extension of embeddings and the two quantifier theory, *Theoretical Computer Science* **97** (1992), 263-284 (with T. Slaman).

57. Working below a high recursively enumerable degree, *Journal of Symbolic Logic* **58** (1993), 824-859 (with T. Slaman).

58. Degrees of constructibility, in *Set theory of the Continuum*, H. Judah, W. Just and H. Woodin eds., *MSRI Publications* **26**, Springer-Verlag, Berlin, 1992, 123-135.

59. The n-r. e. a. enumeration degrees are dense, *Archive for Mathematical Logic* **31** (1992), 227-285 (with A. Lachlan).

60. The theory of the recursively enumerable weak truth table degrees is undecidable, *Journal of Symbolic Logic* **57** (1992), 864-874 (with K. Ambos-Spies and A. Nies).

61. Countable thin Π^0_1 classes, *Annals of Pure and Applied Logic* **59** (1993) 79-139 (with D. Cenzer, R. Downey and C. Jockusch).

62. Undecidability and 1-types in the r. e. degrees, *Annals of Pure and Applied Logic* **63** (1993), 3-37 (with K. Ambos-Spies).

63. On the strength of Fraïssé's conjecture, in *Logical Methods*, J. N. C. Crossley, J. Remmel, R. A. Shore and M. Sweedler, eds., Birkhäuser, Boston, 1993, 782-813.

64. Interpreting true arithmetic in the theory of the r. e. truth table degrees, *Annals of Pure and Applied Logic*, **75** (1995), 269-311 (with A. Nies).

65. Degree theoretic definitions of the low_2 recursively enumerable sets, *Journal of Symbolic Logic* **60** (1995), 727-756 (with R. Downey).

66. Jumps of minimal degrees below $\mathbf{0}'$, *Journal of the London Mathematical Society* **54** (1996), 417-439 (with R. Downey and S. Lempp).

67. Highness and bounding minimal pairs, *Mathematical Logic Quarterly* **39** (1993), 475-491 (with R. Downey and S. Lempp)

68. The theories of the T, tt and wtt r. e. degrees: undecidability and beyond, in *Proc. IX Latin American Symposium on Mathematical Logic (part 1)*, Notas de Lo'gica Mathema'tica **38**, Universidad Nacional del Sur, Bahia Blanca, Argentina, 1993, 61-70.

69. *Logical Methods: In Honor of Anil Nerode's Sixtieth Birthday*, Birkhäuser, Boston, Mass., 1993 (edited with J. N. C. Crossley, J. Remmel and M. Sweedler).

70. *Logic for Applications*, Texts and Monographs in Computer Science, Springer-Verlag, New York, 1993 (with A. Nerode); 2^{nd} ed., Graduate Texts in Computer Science, Springer-Verlag, New York, 1997 (with A. Nerode).

71. Conjectures and questions from Gerald Sacks's *Degrees of Unsolvability*, *Archive for Mathematical Logic* **36** (1997), 233-253.

72. Lattice embeddings below a nonlow_2 recursively enumerable degree, *Israel Journal of Mathematics*, **94** (1996), 221-246 (with R. Downey).

73. Interpolating d-r. e. and REA degrees between r. e. degrees, *Annals of Pure and Applied Logic* **78** (1996), 29-56 (with M. Arslanov and S. Lempp).

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