

Robin Pemantle
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CURRICULUM VITAE

Born: June 12, 1963, Walnut Creek, CA. U.S. citizen.

Education:

Ph.D. in probability theory under the supervision of Persi Diaconis (Harvard) from the Massachusetts Institute of Technology in August, 1988.

B.A. in pure mathematics from the University of California at Berkeley in June, 1984.

Professional experience:

June 2003 - present: Merriam Term Professor of Mathematics at the University of Pennsylvania. (Undergraduate Chair 2011-2014)

September 1999 - September 2003: Professor of Mathematics at the Ohio State University.

September 1991 - August 1999: Assistant / Associate (1994) / Full (1998) Professor of Mathematics at the University of Wisconsin-Madison.

September 1990 - December 1991: Andreotti Assistant Professor of Mathematics and N.S.F. Post-doctoral Fellow at Oregon State University.

September 1989 - September 1990: N.S.F. postdoctoral fellow and M.S.I. postdoctoral research fellow in the department of mathematics at Cornell University and the Mathematical Sciences Institute.

June 1988 - September 1989: N.S.F. postdoctoral fellow in the department of statistics at the University of California at Berkeley.

Honors and awards:

Simons Fellow, 2016
American Mathematical Society Fellow, elected 2012
Institute of Mathematical Statistics Fellow, elected 2001
Romnes Fellowship awarded 1997
Presidential Faculty Fellowship awarded 1993 (PFF=PYI=CAREER)
Sloan Foundation Fellowship awarded 1993.
Rollo Davidson Prize, awarded 1993.
Lilly Teaching Fellowship awarded 1993.
N.S.F. postdoctoral fellowship awarded 1988.
N.S.F. graduate fellowship awarded 1984.
Top five in the William Lowell Putnam Math Competition, 1981.

Doctoral dissertations supervised

Manuel Lladser (OSU, 2003), Andrew Bressler (Penn, 2009), Tong Zhu (Penn, 2010), Michael Lugo (Penn, 2010), Tim DeVries (Penn, 2011), Omar Abuzzahab (Penn, 2013), Jonathan Kariv (Penn, 2013), Shanshan Ding (Penn, 2014), Sneha Subramanian (Penn, 2014), Torin Greenwood (Penn, 2015), Julius Poh (Penn, 2015).

Current doctoral students: Albert Chen, Josh Rosenberg, Kostis Karatapanis, Marcus Michelen, Debapratim Banerjee, Somabha Mukherjee

Grants

NSF grants: DMS-1612674, DMS-1209117, DMS-0905937, DMS-0603821, DMS-0103635, DMS-9803249, DMS-9353149, DMS-9300191.

Research interests:

Probability theory and Combinatorics

Service

David Robbins Prize Committee, Mathematical Association of America (2014–2020)
University SAIL committee (structured active in-class learning), 2013–present
Undergraduate Chair, Department of Mathematics, 2011–2014
Math+X committee, 2011–2013

Evolution cluster committee 2012–2013

Recent invited talks:

AMS regional meeting, Bloomington, IN	April, 2017
Tulane University Mathematics Colloquium	February, 2016
University of Washington Probability Seminar	December, 2016
Minerva Lectures, Columbia University	November, 2016
Indiana University Probability Seminar	November, 2016
Brown University Discrete Math Seminar	November, 2016
ANALCO, Barcelona	January, 2017
Columbia Probability Seminar	October, 2016
Columbia-Courant Probability Day	October, 2016
Workshop on Combinatorics and Probability, Banff	October, 2016
U. Chicago Probability Seminar	February, 2016
UW-MSR Research Institute on Machine Learning	August, 2015
University of Washington CS Theory seminar	May, 2015
MIT Probability seminar	May, 2015
Carnegie Mellon Algorithms and C & O seminar	April, 2015

Teaching:

I have developed a year-long probability course at the graduate level, for graduate students in pure and applied math, statistics and engineering. I have taught this at Penn in 2004-2016.

I developed a one-semester calculus course for business students, incorporating parts of Calc I, II and III and replacing the (somewhat absurd) Calc II requirement. This course, Math 110, is taught in an Active Learning format.

I have taught a number of graduate level topics courses including: Analytic Combinatorics in Several Variables, Random walks on graphs, a reading course in original papers in classical probability and statistical mechanics; I have supervised reading courses in point processes, random graphs, probabilistic number theory, and computational algebraic geometry.

Experimental teaching:

Active learning calculus at Penn 2013-2014

Taught math enrichment to children of ages 10-13 at Black Pine Circle School during the years

1980-1984

Penn Math 123: academically based community service, teaching geometry in an urban tenth grade classroom, 2004

OSU Math 151A (calculus problem-solving curriculum), 2000

OSU Math 105-106 (math for elementary school teachers, active learning) 2002

Wisconsin Math 130-132 (math for elementary school teachers, active learning) 1993–1998

Summer Institute in Mathematics knot theory, Berkeley, 1991. The SMI is a program for minority students at the college level who are interested in careers in mathematics.

MIT Experimental Study Group ordinary differential equations, partial Moore method course, 1987-88.

Books

Analytic Combinatorics in Several Variables. R. Pemantle and M. C. Wilson. Cambridge Studies in Advanced Mathematics No. 140. Cambridge University Press, 2013. ISBN-13: 9781107031579.

Articles

- [1] Pemantle, R. (1988). Phase transition in reinforced random walk and RWRE on trees. *Ann. Probab.* **16** 1229 - 1241.
- [2] Pemantle, R. (1989). Randomization time for the overhand shuffle. *J. Theor. Prob.* **2** 37 - 49.
- [3] Pemantle, R. (1990). Nonconvergence to unstable points in urn models and stochastic approximations. *Ann. Probab.* **18** 698 - 712.
- [4] Pemantle, R. (1990). A time-dependent version of Polya's urn. *Jour. Theor. Prob.* **3** 627 - 637.
- [5] Fill, J. and Pemantle, R. (1993). Oriented percolation, first-passage percolation and covering times for Richardson's model on the n -cube. *Ann. Appl. Prob.* **3** 593 - 629.
- [6] Pemantle, R. (1990). Vertex-reinforced random walk. *Prob. Theor. and Rel. Fields* **92** 117 - 136.
- [7] Pemantle, R. (1991). When are touchpoints limits for generalized Polya urns? *Proc. AMS* **113** 235 - 243.
- [8] Pemantle, R. and Peres, Y. (1995). Critical RWRE on trees and tree-indexed random walks. *Ann. Probab.* **23** 105 - 140.

- [9] Pemantle, R. (1991). Choosing a spanning tree for the integer lattice uniformly. *Ann. Probab.* **19** 1559 - 1574.
- [10] Pemantle, R. and Lyons, R. (1992). Random walk in a random environment and first-passage percolation on trees. *Ann. Probab.* **20** 125 - 136.
- [11] Pemantle, R., Propp, J. and Ullman, D. (1992). On tensor powers of integer programs. *SIAM J. Disc. Math.* **5** 127 - 143.
- [12] Pemantle, R. (1992). Automorphism-invariant measures on trees. *Ann. Probab.* **20** 1549 - 1566.
- [13] Pemantle, R. (1992). The contact process on trees. *Ann. Probab.* **20** 2089 - 2116.
- [14] Pemantle, R. and Penrose, M. (1992). On path integrals for the high-dimensional Brownian bridge. *J. Comput. Appl. Math.* **44** 381 - 390.
- [15] Burton, R. and Pemantle, R. (1993). Local characteristics, entropy and limit theorems for uniform spanning trees and domino tilings via transfer-impedances. *Ann. Prob.* **21** 1329 - 1371.
- [16] Pemantle, R. (1993). Critical RWRE on trees of exponential growth. *Proc. Sem. Stoch. Pro. 1992, Burdzy and Bass, editors*, 221 - 240.
- [17] Pemantle, R. and Peres, Y. (1994). Planar first-passage times are not tight. In: *Probability and Phase Transition*, G. Grimmett Editor, 261 - 264. Kluwer: Boston.
- [18] Pemantle, R. and Peres, Y. (1994). Domination between trees and application to an explosion problem. *Ann. Probab.* **22** 180 - 194.
- [19] Pemantle, R. (1994). A shuffle that mixes sets of any fixed size much faster than it mixes the whole deck. *Rand. Struct. Alg.* **9** 609 - 625.
- [20] Pemantle, R. (1994). Uniform random spanning trees. In: *Topics in contemporary probability and its applications*, J. L. Snell, editor, pages 1 - 54. CRC Press: Boca Raton.
- [21] Pemantle, R. (1995). Tree-indexed processes. *Stat. Sci.* **5** 200 - 213.
- [22] Pemantle, R. and Peres, Y. (1995). Galton-Watson trees with the same mean have the same polar sets. *Ann. Probab.* **23** 1102 - 1124.
- [23] Benjamini, I., Pemantle, R. and Peres, Y. (1995). Martin capacity for Markov chains. *Ann. Probab.* **23** 1332 - 1346.
- [24] Lyons, R., Pemantle, R. and Peres, Y. (1995). A conceptual proof of the Kesten-Stigum theorem. *Ann. Probab.* **23** 1125 - 1138.

- [25] Diaconis, P., Holmes, S., Janson, S., Lalley, S. and Pemantle, R. (1995). Metrics on compositions and coincidences among renewal processes. In: *Random Discrete Structures*, 81 - 101, *IMA Vol. Math. Appl.* **76**. Springer: New York.
- [26] Lyons, R., Pemantle, R. and Peres, Y. (1995). Ergodic Theory on Galton Watson trees: Speed of random walk and dimension of harmonic measure on Galton-Watson trees. *Ergodic Theory and Dynamical Systems* **15** 593 - 619.
- [27] Pemantle, R. (1996). The probability that Brownian motion almost covers a line. *Ann. IHP, Prob. and Stat.* **33** 147 - 165.
- [28] Pemantle, R. (1996). Maximum variation of total risk. *Stat. Prob. Letters* **28** pages 285 - 289.
- [29] Benjamini, I., Pemantle, R. and Peres, Y. (1996). Random walks in varying dimensions. *J. Theor. Prob.* **9** 231 - 244.
- [30] Lyons, R., Pemantle, R. and Peres, Y. (1996). Random walks on the Lamplighter group. *Ann. Probab.* **24** 1993 - 2006.
- [31] Pemantle, R. and Peres, Y. (1996). On which graphs are all random walks in random environments transient? In: *Random Discrete Structures*, 207 - 211, *IMA Vol. Math. Appl.* **76**. Springer: New York.
- [32] Pemantle, R., Peres, Y. and Shapiro, J. (1996). The trace of spatial Brownian motion is capacity-equivalent to the unit square. *P.T.R.F.* **106** 379 - 399.
- [33] Lyons, R., Pemantle, R. and Peres, Y. (1996). Biased random walks on Galton-Watson trees. *P.T.R.F.* **106** 249 - 264.
- [34] Barlow, M., Pemantle, R. and Perkins, E. (1997). Diffusion limited aggregation on a homogeneous tree. *Prob. Th. Rel. Fields* **107** 1 - 60.
- [35] Pemantle, R. (1997). Sharpness of second moment criteria for branching and tree-indexed processes. In: *Classical and modern branching processes*, 257 - 262, *IMA Vol. Math. Appl.* **84**. Springer: New York.
- [36] Lyons, R., Pemantle, R. and Peres, Y. (1997). Unsolved problems concerning random walks on trees. In: *Classical and modern branching processes*, 223 - 237, *IMA Vol. Math. Appl.* **84**. Springer: New York.
- [37] Lyons, R., Pemantle, R. and Peres, Y. (1997). A conceptual proof of the Kesten-Stigum Theorem for multi-type branching processes. In: *Classical and modern branching processes*, 181 - 186, *IMA Vol. Math. Appl.* **84**. Springer: New York.
- [38] Bishop, C., Jones, P., Pemantle, R. and Peres, Y. (1997). Brownian frontier has dimension greater than 1. *J. Func. Anal.* **43** 309 - 336.

- [39] Hwang, J. and Pemantle, R. (1997). Evaluators of estimates of statistical significance under a class of proper loss functions. *Statistics and Decisions* **15** 103 - 128.
- [40] Chayes, L., Pemantle, R. and Peres, Y. (1997). No directed fractal percolation in zero area. *J. Stat. Phys.* **88** 1353 - 1362.
- [41] Pemantle, R. and Volkov, S. (1998). Markov chains in a field of traps. *J. Theor. Prob.* **11** 561 - 569.
- [42] Häggström, O. and Pemantle, R. (1998). First passage percolation and a model for competing spatial growth. *J. Appl. Prob.* **35** 683 - 692.
- [43] Adelman, O., Burdzy, K. and Pemantle, R. (1998). Sets avoided by Brownian motion. *Ann. Prob.* **26** 429 - 464.
- [44] Benjamini, I., Pemantle, R. and Peres, Y. (1998). Unpredictable paths and percolation. *Ann. Probab.* **26** 1198 - 1211.
- [45] Lyons, R., Pemantle, R. and Peres, Y. (1999). Resistance bounds for first-passage percolation and maximum flow. *J. Comb. Theor. A* **86** 158 - 168.
- [46] Häggström, O. and Pemantle, R. (1999). On near-critical and dynamical percolation in the tree case. *Rand. Struc. Alg.* **15** 311 - 318.
- [47] Pemantle, R. and Volkov, S. (1999). Vertex-reinforced random walk on Z has finite range. *Ann. Probab.* **27** 1368 - 1388.
- [48] Pemantle, R. and Steif, J. (1999). Robust phase transitions for Heisenberg and other models on general trees. *Ann. Probab.* **27** 876 - 912.
- [49] Pemantle, R. and Rosenthal, J. (1999). Moment conditions for a sequence with negative drift to be uniformly bounded in L^r . *Stoch. Pro. Appl.* **82**, 143 - 155.
- [50] Khoshnevisan, D. and Pemantle, R. (2000). Sojourn times of Brownian sheet. *Period. Math. Hungar.* **41**, 187–194
- [51] Skyrms, B. and Pemantle, R. (2000). A dynamic model of social network formation. *Proc. NAS* **97** 9340–9346. Reprinted in: *Adaptive Networks 231–251*, T. Gross and M. Sayama editors. Springer: New York. ISBN: 978-3-642-01283-9.
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- [58] Levin, D., Pemantle, R. and Peres, Y. (2001). A phase transition in random coin tossing. *Ann. Probab.* **29**, 1637–1669.
- [59] Pemantle, R. and Wilson, M. (2002). Asymptotics of multivariate sequences, part I: smooth points of the singular variety. *JCT A* **97**, 129–161.
- [60] Cohn, H., Pemantle, R., Propp, J. (2002). Generating a random sink-free orientation in quadratic time. *Elec. J. Comb.* **9**(1), paper R10.
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- [62] Pemantle, R. and Skyrms, B. (2003). Network formation by reinforcement learning: the long and the medium run. *Math. Soc. Sci.* **48**, 315–327.
- [63] Kakade, S., Kearns, M., Ortiz, L., Pemantle, R. and Suri, S. (2004). The economics of social networks. In: *Proceedings of NIPS, 2004*.
- [64] Pemantle, R. and Wilson, M. (2004). Asymptotics of multivariate sequences, part II: Multiple points of the singular variety. *Comb. Prob. Comput.* **13**, 735–761.
- [65] Pemantle, R. and Skyrms, B. (2004). Time to absorption in discounted reinforcement models. *Stoch. Proc. Appl.* **109**, 1–12.
- [66] Skyrms, B. and Pemantle, R. (2004). Learning to network. In: *The Place of Probability in Science*, ed. Ellery Eells and James Fetzer. Open Court.
- [67] Corteel, S., Louchard, G. and Pemantle, R. (2006). Common intervals in permutations. *Disc. Math. Theor. Comp. Sci.* **8** 189–214. Extended abstract appeared in *Mathematics and Computer Science III*, (M. Drmota, P. Flajolet, D. Gardy and B. Gittenberger, Editors) pages 3–14, (2004).
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- [69] Hitczenko, P. and Pemantle, R. (2004). Central limit theorem for the size of the range of a renewal process. *Stat. Prob. Let.* **72**, 249–264.

- [70] Pemantle, R. (2005). Poor performance of random random number generators. *J. Algorithms* **54**, 72–81.
- [71] Pemantle, R. (2005). A probabilistic model for the degree of the cancellation polynomial in Gosper’s Algorithm. *J. Algorithms* **54**, 58–71.
- [72] Pemantle, R. and Ward, M. (2006). Exploring the average values of Boolean functions via asymptotics and experimentation. In: *The Proceedings of the Third Workshop on Analytic Algorithmic and Combinatorics (ANALCO’06)* 253–262.
- [73] Bressler, A. and Pemantle, R. (2007). Quantum random walk in one dimension via generating functions. In: *DMTCS Proceedings, 2007 Conference on Analysis of Algorithms. Extended Abstract, 11 pages*.
- [74] Balogh, J. and Pemantle, R. (2007). The Klee-Minty random edge chain moves with linear speed. *Rand. Struct. Alg.* **30**, 464–483.
- [75] Pemantle, R. and Peres, Y. (2007). When does a set intersect the set of Brownian double points? *Ann. Probab.* **35**, 2044–2062.
- [76] Pemantle, R. and Schneider, C. (2007). When is $0.999\dots$ equal to 1? *Amer. Math. Monthly* **114**, 344–350.
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- [78] Pemantle, R. and Wilson, M. (2008). Twenty combinatorial examples of asymptotics derived from multivariate generating functions. *SIAM Review*, vol. 50, 199–272.
- [79] Croot, E., Granville, A., Pemantle, R. and Tetali, P. (2008). Running time predictions for factoring algorithms. In: *Algorithmic Number Theory (Lecture Notes in Computer Science vol. 5011)*. Springer: Berlin.
- [80] Pemantle, R. (2009). Search cost for a nearly optimal path in a binary tree. *Ann. Appl. Prob.* **19**, 1273–1291.
- [81] Argiento, R., Pemantle, R., Skyrms, B. and Volkov, S. (2009). Learning to signal: analysis of a micro-level reinforcement model. *Stoch. Proc. Appl.* **119**, 373–390.
- [82] Holroyd, A. Pemantle, R., Peres, Y., and Schramm, O. (2009). Poisson matching. *Ann. I.H.P. Prob. Stat.* **45**, 266–287.
- [83] Pemantle, R. and Wilf, H. (2009). Counting nondecreasing integer sequences lying below a barrier. *Elec. J. Comb.* **16**, research paper # 60, 7 pages.
- [84] Pemantle, R. and Wilson, M. (2010). Asymptotic expansions of oscillatory integrals with complex phase. *To appear in Proceedings of the AMS Special session on Algorithmic Probability and Combinatorics (refereed), Lladser, Maier, Mishna and Rechnitzer editors, 18 pages*.

- [85] Bressler, A., Greenwood, T., Pemantle, R. and Petkovsek, M. (2010). Quantum random walk on the integer lattice: examples and phenomena. *To appear in Proceedings of the AMS Special session on Algorithmic Probability and Combinatorics (refereed)*, Lladser, Maier, Mishna and Rechnitzer editors, 17 pages.
- [86] Pemantle, R. (2010). Analytic combinatorics in several variables: an overview. *To appear in Contemporary Mathematics*, **520**, 195–220. AMS Special session on Algorithmic Probability and Combinatorics (refereed), Lladser, Maier, Mishna and Rechnitzer editors, 24 pages.
- [87] Pemantle, R. and Peres, Y. (2010). The critical Ising model on trees, concave recursions and nonlinear capacity. *Ann. Probab.* **38**, 184–206.
- [88] Baryshnikov, Y., Brady, W., Bressler, A. and Pemantle, R. (2010). Two-dimensional quantum random walk. *J. Stat. Phys.* **142** 78–107.
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- [91] Croot, E., Granville, A., Pemantle, R. and Tetali, P. (2012). Sharp transitions in making squares. *Ann. Math.* **175**, 1–45.
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- [100] Pemantle, R., Peres, Y. and Rivin, I. (2015). Four random permutations conjugated by an adversary generate \mathcal{S}_n with high probability. *Rand. Struc. Algor.*, to appear, 26 pages.
- [101] Satopää, V., Pemantle, R. and Ungar, L. (2015). Modeling probability forecasts via information diversity. *J. Amer. Stat. Assoc.*, to appear, 31 pages.
- [102] Subramanian, S. and Pemantle, R. (2015). Repeated differentiation evens the spacing of zeros when the zeros are initially translation-invariant and Poisson. *Trans. AMS*, to appear, 24 pages.
- [103] Lazar, E. and Pemantle, R. (2015). Coarsening in One Dimension: Invariant and asymptotic states. *Israel J. Math.*, to appear, 18 pages.
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- [105] Satopää, V., Jensen, S., Pemantle, R. and Ungar, L. (2015). Partial Information Framework: Aggregating estimates from diverse information sources. *Preprint*, 30 pages.
- [106] Ernst, P., Satopää, V., Pemantle, R. and Ungar, L. (2016). Bayesian aggregation of two forecasts in the partial information framework. *Preprint*, 14 pages.
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- [108] Ghosh, S., Liggett, T. and Pemantle, R. (2016). Multivariate CLT follows from the strong Rayleigh property. *Preprint*, 8 pages.
- [109] Mutz, D. and Pemantle, R. (2016). The perils of balance testing in experimental design: Messy analyses of clean data. *Preprint*, 28 pages.