Curriculum Vitae: Steven J. Miller

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Williams College
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Nationality: American.
Thesis Advisors: Peter Sarnak (Princeton University), Henryk Iwaniec (Rutgers University)

Research Interests: Distribution of zeros and n-level statistics for families of L-functions, especially families of elliptic curves with rank over $\mathbb{Q}(T)$, Random Matrix Theory, Random Graphs, Elliptic Curves, Additive, Analytic and Computational Number Theory, Probability Theory and Statistics, Benford's Law, the L-function Ratios Conjecture, Cryptography, Sabermetrics and Linear Programming.

Education

Ph. D., Mathematics	Princeton University, 2002.
M. A., Mathematics	Princeton University, 1998.
B. S., Mathematics & Physics	Yale University, 1996 (summa cum laude).

Positions

Visiting Professor	Smith College	2011 (Fall)
Visiting Professor	Mount Holyoke College	2011 (Fall)
Assistant Professor	Williams College	2008 -
Tamarkin Assistant Professor	Brown University	2005 - 2008
Visiting Assistant Professor	Brown University	2004 - 2005
Ross Assistant Professor	The Ohio State University	2003 - 2004
Visiting Scholar	Boston University	2004
VIGRE Consultant	Princeton University	2003 - 2004
Post-doctoral Fellow	American Institute of Mathematics	2003
Instructor	Princeton University	2002 - 2003
Research Scientist	Courant Institute, NYU	2002
Lecturer	Princeton University	2001 - 2002

Individual Grants

1. NSF Grant DMS0970067 (Analysis, Number Theory and Combinatorics): *Investigations of L-functions and Benford's Law*, June 1, 2010 to June 1, 2013, $112,521.
2. DHS Center at Rutgers (for work on a cryptography project with Midge Cozzens): January 1, 2010 to December 31, 2010: $3,000.
3. NSF Grant DMS0600848 (Analysis, Number Theory and Combinatorics): *Investigations on low-lying zeros of L-functions*, July 2006 - June 2009, $108,000 (relabeled DMS0855257; no cost extension to 2010 due to birth of daughter).
4. NSF Graduate Fellowship, 1998 - 2000.

Conference and REU Grants

1. NSF Grant DMS0850577 (The Williams College SMALL REU Project), summer support in 2009 and, with Williams College, support for summer REU students.

2. NSF Grant DMS536991 (MAA Regional Undergraduate Mathematics Conferences program): *Brown University Symposium for Undergraduates in the Mathematical Sciences*, March 8, 2008, $1,500.

3. Office of the Vice President for Research, Brown University: Conference on the Theory and Applications of Benford's Law (December 16th - 18th, 2007, Santa Fe, NM), $5,000.

4. NSF Grant DMS0753043 (Probability program), Conference on the Theory and Applications of Benford's Law (December 16th - 18th, 2007, Santa Fe, NM), $13,368.

5. NSF Grant DMS536991 (MAA Regional Undergraduate Mathematics Conferences program): *Brown University Symposium for Undergraduates in the Mathematical Sciences*, March 3, 2007, $1,500.

Organized Conferences: Research

1. Theory and Applications of Benford's Law (with Chaouki Abdallah, Greg Heileman, Ted Hill and Fernando Perez-Gonzalez), Santa Fe, NM, December 16-18, 2007.

2. AMS Sectional Special Session on Analytic Number Theory (with Alina Bucur, Stephen D. Miller and Akshay Venkatesh), New York, NY, March 15-16, 2008.

3. AMS Sectional Special Session on Random Processes (with Andrew Ledoan and Mihai Stoiciu), Worcester, MA, April 9 - 10, 2011.

Organized Conferences: Undergraduate

1. Symposium for Undergraduates in the Mathematical Sciences, Brown University (faculty advisor for 2006, 2007 and 2008).

2. AMS Sectional Special Session on Undergraduate Research (joint with faculty organizers David Damiano, Giuliana Davidoff, Steven Levandosky and student organizers Amalia Culiuc, Jake Levinson, Sean Pegado, Deirdre Scully and Marisa Zemsky).

3. Panel discussion on REUs and undergraduate research (joint with David Damiano and others TBD), Joint Meetings of the AMS / MAA, Boston 2012.

Bibliography

Papers and Talks available online at http://www.williams.edu/Mathematics/sjmiller/

Papers

1. 1- *and* 2*-level densities for families of elliptic curves: evidence for the underlying group symmetries*, Compositio Mathematica **140** (2004), 952–992.

2. *Distribution of eigenvalues for the ensemble of real symmetric Toeplitz matrices* (with Christopher Hammond), Journal of Theoretical Probability **18** (2005), no. 3, 537–566.

3. *Benford's Law, values of L-functions and the* $3x+1$ *problem* (with Alex Kontorovich), Acta Arithmetica **120** (2005), no. 3, 269–297.

4. *Variation in the number of points on elliptic curves and applications to excess rank*, C. R. Math. Rep. Acad. Sci. Canada **27** (2005), no. 4, 111–120.

5. *Incomplete quadratic exponential sums in several variables* (with Eduardo Dueñez, Amitabha Roy and Howard Straubing), Journal of Number Theory **116** (2006), no. 1, 168–199.

6. *Closed-form Bayesian inference for the logit model via polynomial expansions* (with Eric T. Bradlow and Kevin Dayaratna), Quantitative Marketing and Economics **4** (2006), no. 2, 173–206.

7. *Investigations of zeros near the central point of elliptic curve L-functions*, Experimental Mathematics **15** (2006), no. 3, 257–279.

8. *The low lying zeros of a GL(4) and a GL(6) family of L-functions* (with Eduardo Dueñez), Compositio Mathematica **142** (2006), no. 6, 1403–1425.

9. *Low lying zeros of L–functions with orthogonal symmetry* (with Christopher Hughes), Duke Mathematical Journal **136** (2007), no. 1, 115–172.

10. *Constructing one-parameter families of elliptic curves over $\mathbb{Q}(T)$ with moderate rank* (with Scott Arms and Álvaro Lozano-Robledo), Journal of Number Theory **123** (2007), no. 2, 388–402.

11. *A derivation of the Pythagorean Won-Loss Formula in baseball*, Chance Magazine **20** (2007), no. 1, 40–48 (an abridged version appeared in The Newsletter of the SABR Statistical Analysis Committee **16** (February 2006), no. 1, 17–22).

12. *Distribution of eigenvalues of real symmetric palindromic Toeplitz matrices and circulant matrices* (with Adam Massey and John Sinsheimer), Journal of Theoretical Probability **20** (2007), no. 3, 637–662.

13. *Benford's Law applied to hydrology data - results and relevance to other geophysical data* (with Mark Nigrini), Mathematical Geology **39** (2007), no. 5, 469–490.

14. *When the Cramér-Rao Inequality provides no information*, Communications in Information and Systems **7** (2007), no. 3, 265–272.

15. *The Modulo 1 Central Limit Theorem and Benford's Law for Products* (with Mark Nigrini), International Journal of Algebra **2** (2008), no. 3, 119–130.

16. *A symplectic test of the L-Functions Ratios Conjecture*, Int Math Res Notices (2008) Vol. 2008, article ID rnm146, 36 pages, doi:10.1093/imrn/rnm146.

17. *An identity for sums of polylogarithm functions*, Integers: Electronic Journal Of Combinatorial Number Theory **8** (2008), #A15.

18. *A probabilistic proof of Wallis' formula for π*, Amer. Math. Monthly **115** (2008), no. 8, 740–745.

19. *The distribution of the second largest eigenvalue in families of random regular graphs* (with Tim Novikoff and Anthony Sabelli), Experimental Mathematics **17** (2008), no. 2, 231–244.

20. *Order statistics and Benford's law* (with Mark Nigrini), International Journal of Mathematics and Mathematical Sciences, Volume 2008 (2008), Article ID 382948, 19 pages. doi:10.1155/2008/382948

21. *Lower order terms in the 1-level density for families of holomorphic cuspidal newforms*, Acta Arithmetica **137** (2009), 51–98.

22. *Chains of distributions, hierarchical Bayesian models and Benford's Law* (with D. Jang, J. U. Kang, A. Kruckman and J. Kudo), Journal of Algebra, Number Theory: Advances and Applications, volume 1, number 1 (March 2009), 37–60.

23. *An orthogonal test of the L-Functions Ratios Conjecture*, Proceedings of the London Mathematical Society 2009, doi:10.1112/plms/pdp009.

24. *Silver Scheduler: a demand-driven modeling approach for the construction of micro-schedules of movies in a multiplex* (with Jehoshua Eliashberg, Quintus Hegie, Jason Ho, Dennis Huisman, Sanjeev Swami, Charles B. Weinberg and Berend Wierenga), Intern. J. of Research in Marketing (2009), doi:10.1016/j.ijresmar.2008.09.004 (lead article, and won the IJRM Best Paper Award for 2009).

25. *The effect of convolving families of L-functions on the underlying group symmetries* (with Eduardo Dueñez), Proceedings of the London Mathematical Society, 2009; doi: 10.1112/plms/pdp018.

26. *When almost all sets are difference dominated* (with Peter Hegarty), Random Structures and Algorithms **35** (2009), no. 1, 118–136.

27. *Nuclei, Primes and the Random Matrix Connection* (with Frank W. K. Firk), invited submission to Symmetry **1** (2009), 64–105; doi:10.3390/sym1010064.

28. *Data diagnostics using second order tests of Benford's Law* (with Mark Nigrini), Auditing: A Journal of Practice and Theory **28** (2009), no. 2, 305–324. doi: 10.2308/aud.2009.28.2.305

29. Explicit constructions of infinite families of MSTD sets (with Brooke Orosz and Dan Scheinerman), Journal of Number Theory **130** (2010) 1221–1233.

30. *A unitary test of the L-functions Ratios Conjecture* (with John Goes, Steven Jackson, David Montague, Kesinee Ninsuwan, Ryan Peckner and Thuy Pham), Journal of Number Theory **130** (2010), no. 10, 2238–2258.

31. *Towards an 'average' version of the Birch and Swinnerton-Dyer Conjecture* (with John Goes), Journal of Number Theory **130** (2010), no. 10, 2341–2358.

32. *An Orthogonal Test of the L-functions Ratios Conjecture, II* (with David Montague), Acta Arith. **146** (2011), 53–90.

33. *Rational irrationality proofs* (with David Montague), to appear in Mathematics Magazine.

34. *Explicit constructions of infinite families of MSTD sets* (with Dan Scheinerman), Additive Number Theory: Festschrift In Honor of the Sixtieth Birthday of Melvyn B. Nathanson (David Chudnovsky and Gregory Chudnovsky, editors), Springer-Verlag, 2010.

35. *Demand-driven scheduling of movies in a multiplex* (with Jehoshua Eliashberg and Charles B. Weinberg), newsletter of the European Marketing Academy, October 2010 (requested summary of Silver-Scheduler paper in honor of it receiving the IJRM Best Paper Award for 2009).

36. *The lowest eigenvalue of Jacobi Random Matrix Ensembles and Painlevé VI*, (with Eduardo Dueñez, Duc Khiem Huynh, Jon Keating and Nina Snaith), Journal of Physics A: Mathematical and Theoretical **43** (2010) 405204 (27pp).

37. *Effective equidistribution and the Sato-Tate law for families of elliptic curves* (with M. Ram Murty), Journal of Number Theory **131** (2011), no. 1, 25–44.

38. Isoperimetric Sets of Integers (with Frank Morgan, Edward Newkirk, Lori Pedersen and Deividas Seferis), Mathematics Magazine **84** (Feb. 2011), 37–42).

39. *An elliptic curve family test of the Ratios Conjecture* (with Duc Khiem Huynh and Ralph Morrison), Journal of Number Theory **131** (2011), 1117–1147.

40. *On the number of summands in Zeckendorf decompositions* (with Murat Koloğlu, Gene S. Kopp and Yinghui Wang), Fibonacci Quarterly **49** (2011), no. 2, 116–130.

41. *Distribution of eigenvalues for highly palindromic real symmetric Toeplitz matrices* (with Steven Jackson and Thuy Pham), to appear in the Journal of Theoretical Probability.

42. *A combinatorial identity for studying Sato-Tate type problems* (with M. Ram Murty and Frederick Strauch), to appear in Rendiconti del Seminario Matematico.

43. *Moments of the rank of elliptic curves* (with Siman Wong), to appear in the Canadian Journal of Mathematics.

44. *The real analogue of the Schwarz lemma* (with David Thompson), to appear in the American Mathematical Monthly.

45. *The Limiting Spectral Measure for Ensembles of Symmetric Block Circulant Matrices* (with Murat Koloğlu, Gene S. Kopp, Frederick W. Strauch and Wentao Xiong), to appear in the Journal of Theoretical Probability.

46. *Gaussian Behavior in Generalized Zeckendorf Decompositions* (with Yinghui Wang), to appear in the conference proceedings of the 2011 Combinatorial and Additive Number Theory Conference.

47. *Finding and Counting MSTD sets* (with Geoffrey Iyer, Oleg Lazarev and Liyang Zhang), to appear in the conference proceedings of the 2011 Combinatorial and Additive Number Theory Conference.

48. *Generalized Ramanujan Primes* (with Nadine Amersi, Olivia Beckwith, Ryan Ronan and Jonathan Sondow), to appear in the conference proceedings of the 2011 Combinatorial and Additive Number Theory Conference.

Books

1. *An Invitation to Modern Number Theory* (with Ramin Takloo-Bighash), Princeton University Press, Princeton, NJ, 2006, 503 pages.

Papers under Review

1. *From Fibonacci numbers to Central Limit Type Theorems* (with Yinghui Wang), submitted February 2011 to Journal of Combinatorial Theory, Series A.

2. *The Weibull distribution and Benford's law* (with Victoria Cuff and Allie Lewis), submitted March 2011 to The American Statistician.

3. *Quadratic fields with cyclic 2-class groups* (with Carlos Dominguez and Siman Wong), submitted May 2011 to the Journal of Number Theory.

4. *Explicit Constructions of Large Families of Generalized More Sums Than Differences Sets* (with Luc Robinson and Sean Pegado), submitted August 2011 to Integers.

5. *Generalized More Sums Than Differences Sets* (with Geoffrey Iyer, Oleg Lazarev and Liyang Zhang), submitted August 2011 to the Journal of Number Theory.

6. *Low-lying zeros of number field L-functions* (with Ryan Peckner), submitted September 2011 to Acta Arithmetica.

7. *Virus Dynamics on Spoke and Star Graphs* (with Thealexa Becker, Alec Greaves-Tunnell, Leo Kontorovich, Pradeep Ravikumar, Karen Shen), submitted November 2011 to SIAM Journal on Applied Dynamical Systems.

8. *Benford's Law and Continuous Dependent Random Variables* (with Thealexa Becker, Ryan Ronan and Alec Greaves-Tunnell), submitted November 2011 to the Journal of Applied Probability.

Preprints

1. *Models for zeros at the central point in families of elliptic curves* (with Eduardo Dueñez, Duc Khiem Huynh, Jon Keating and Nina Snaith).

2. *Low-Lying Zeros of Dirichlet L-Functions* (with Daniel Fiorilli), preprint.

3. *The low-lying zeros of cuspidal Maass forms on* $\mathrm{SL}_2(\mathbb{Z})$ (with Nadine Amersi, Geoffrey Iyer, Oleg Lazarev and Liyang Zhang), preprint.

4. *The Pythagorean Won-Loss Formula and Hockey* (with Kevin Dayaratna), preprint.

5. *Moment Formulas for Ensembles of Classical Compact Groups* (with Geoffrey Iyer), preprint.

6. *The n-level density of zeros of quadratic Dirichletă L-functions* (with Jake Levinson), preprint.

7. *Distribution of Missing Sums in Sumsets* (with Oleg Lazarev), preprint.

8. *Distribution of eigenvalues of weighted, structured matrix ensembles* (with Olivia Beckwith, Karen Shen), preprint.

9. *Gaps between summands in generalized Zeckendorf decompositions* (with Olivia Beckwith), preprint.

10. *Climate, hydrology and election data and Benford's law* (with Victoria Cuff and Allie Lewis), preprint.

11. *The expected eigenvalue distribution of large, weighted d-regular graphs* (with Leo Goldmahker, Cap Khoury and Kesinee Ninsuwan), preprint.

12. *Leading, learning and herding* (with Daniel Stone), preprint.

13. *m-paths and the* $(3x+1)$ *Problem* (with Bruce Adcock, Carlos Dominguez and Sucheta Soundarajan), in preparation.

14. *Extending the support in the* 1*-level density for families of Dirichlet characters*, in preparation.

15. *Using the* 2*-Level Density to Improve Bounds on Excess Rank in Families*, in preparation.

16. *Irrationality measure and lower bounds for* $\pi(x)$, in preparation.

17. *If a prime divides a product...* (with Cesar Silva).

Books in preparation

1. *Theory and Applications of Benford's Law* (senior editor; co-editors Arno Berger and Ted Hill), Princeton University Press, under contract, expected publication date 2013.

2. *The Mathematics of Encryption: An Elementary Introduction* (with Midge Cozzens and Wesley Pegden), AMS Mathematical World series, under contract, expected publication date 2013.

3. *The Probability Lifesaver* (with students at Williams), Princeton University Press, under contract.

Selected Talks (146)

L-Functions and Random Matrix Theory (38)

1. *Random Matrix Theory and elliptic curves: evidence for the underlying group symmetries*, Joint Meeting of the AMS and the UMI, University of Pisa, June 13, 2002; AMS sectional, Salt Lake City, October 27, 2002; Johns Hopkins University, Baltimore, MD, March 3, 2004; Five College Number Theory Seminar, Amherst, MA, April 20, 2004; Boston University, Boston, MA, May 13, 2004.

2. *Ranks of one-parameter families of elliptic curves over* $\mathbb{Q}(T)$ *and thoughts on the excess rank question*, Boston College, March 10, 2003; AMS Sectional, Boulder, October 4, 2003.

3. *Random Matrix Theory models for zeros near the central point (and applications to elliptic curves)*, AMS Sectional, Lawrenceville, NJ, April 2004; Workshop on Spectral Theory and Automorphic Forms, Montréal, Canada, May 8, 2004; Brandeis University, April 1, 2005; Brown University, September 19, 2005; Advances in Number Theory and Random Matrix Theory, Rochester, NY, June 7, 2006.

4. *From Random Matrix Theory to L-functions*, Tel Aviv University, December 23, 2004; Hebrew University, December 27, 2004; Theoretical Physics Seminar, Brown University, April 12, 2006.

5. *Identifying and breaking the symmetry group of zeros of families of L-functions*, Number Theory and Random Matrix Theory Workshop, Canadian Mathematical Society Summer Meeting, Waterloo, Canada, June 1, 2005; Collaborative Number Theory Seminar, CUNY, October 20, 2006; Rutgers University, December 12th, 2006.

6. *Finite conductor models for zeros of elliptic curves*, workshop on L-functions, ranks of elliptic curves, and random matrix theory, Banff, July 12, 2007; AMS Special Session on Number Theory, Wesleyan University, Middletown, CT, October 11, 2008. Expanded version (with results towards an average version of Birch and Swinnerton-Dyer and incorporating discretization and lower order terms in the Jacobi ensemble modeling): University of Rochester, October 13, 2009; Five College Number Theory Seminar, Amherst, November 2, 2009; Williams College, February 26, 2010; Maine-Quebec Number Theory Conference, University of Maine, October 1, 2011; Algebra Seminar, Brown University, October 24, 2011.

7. *A symplectic test of the L-functions Ratios Conjecture*, Algebra Seminar, Brown University, September 17, 2007; AMS Special Session on L-functions and automorphic forms, Courant, NYC, March 16, 2008; Johns Hopkins University, Baltimore, MD, April 4, 2008; Cornell University, June 5, 2008.

8. *From Random Matrix Theory to Number Theory*, Graduate Workshop on Zeta Functions, L-Functions and their Applications, Utah Valley University, June 2, 2009.

9. *Random Matrix Theory and Number Theory: Progress report from the 2009 SMALL REU at Williams College* (presented by my students John Goes, Steven Jackson, David Montague, Eve Ninsuwan, Ryan Peckner and Vincent Pham), Williams College, August 11, 2009.

10. *Towards an "Average" Version of the Birch and Swinnerton-Dyer Conjecture* (presented by John Goes), Young Mathematicians Conference, Ohio State, August 29, 2009.

11. *Low Lying Zeros of Number Field L-Functions* (presented by Ryan Peckner), Young Mathematicians Conference, Ohio State, August 29, 2009.

12. *Tests of the L-Functions Ratios Conjecture*, Maine - Québec Number Theory Conference, October 3, 2009; Rutgers University, March 2, 2010.

13. *The n-level density of zeros of quadratic Dirichlet L-functions* (presented by Jake Levinson), Young Mathematicians Conference, August 19, 2011.

14. *Low-lying zeros of cuspidal Maass forms* (presented by Oleg Lazarev and Liyang Zhang), Young Mathematicians Conference, August 20, 2011; Maine-Quebec Number Theory Conference, University of Maine, October 1, 2011.

Benford's Law (22)

1. *Benford's Law, values of L-functions and the* $3x+1$ *problem*, Boston College, October 19, 2004; University of Michigan, November 15, 2004; University of Arizona, January 11, 2006; Brown University, March 20, 2006; Boston University, April 9, 2007 (a variant was given at PROMYS at Boston University on July 16, 2007); Special Session on Number Theory, AMS Sectional Meeting, Worcester, MA, April 25, 2009. Another variant, *Benford's Law: Why the IRS might care about the* $3x+1$ *problem and* $\zeta(s)$, was given at Western New England College (2/11/08), Smith College (10/7/08), Williams College (10/21/08) and Central Connecticut State University (9/25/2009), and a new variant (*Benford's Law: Why the IRS cares about number theory*) was given at Bentley University (2/1/10).

2. *Benford's Law and order statistics*, Brown University, February 1, 2006.

3. *Poisson Summation and Benford's Law: From values of L-functions to the 3x+1 Problem to products of random variables*, Bristol University, December 12, 2007; Workshop on Applications of Benford's Law, Sante Fe, NM, December 18, 2007.

4. *The logarithmic link between economic, hydrologic, and seismic statistics* (with Mark Nigrini), Workshop on Applications of Benford's Law, Sante Fe, NM, December 17, 2007.

5. *Chains of distributions and Benford's Law* (with Dennis Jang, Jung Uk Kang, Alex Kruckman and Jun Kudo), Workshop on Applications of Benford's Law, Sante Fe, NM, December 17, 2007.

6. *Theory and Applications of Benford's Law, or: Why the IRS should care about number theory!*, IRS, Boston office, March 28, 2008 (with Mark Nigrini); Williams College: SMALL Summer Colloquium, June 23, 2010; Hampshire College, July 14, 2011.

7. *Theory and Applications of Benford's Law: Analysis of election and climate data and the Weibull distribution* (Victoria Cuff and Allie Lewis, presenters), SMALL progress report, August 3, 2010, and Shenandoah Undergraduate Mathematics and Statistics Conference, October 23, 2010 (Allie Lewis, presenter).

8. *Benford's law and dependent random variables* (presented by Thealexa Becker), WiMiN Conference, September 24, 2011.

Eigenvalue Statistics (13)

1. *Eigenvalue statistics for ensembles of random matrices: Toeplitz ensembles and Diophantine obstructions*, Probability and Ergodic Theory Seminar, Ohio State, October 30, 2003; Boston University, June 7, 2004; Brown University, September 15, 2004.

2. *Random matrix theory and real symmetric palindromic Toeplitz matrices*, Brown University, March 21, 2007.

3. *On the probability that random graphs are Ramanujan*, Expanders and Ramanujan Graphs: Construction and Applications, AMS National Meeting, San Diego, January 9, 2008.

4. *Eigenvalue Statistics of Toeplitz and Block m-Circulant Ensembles* (Gene Kopp and Murat Koloğlu, presenters), SMALL progress report, August 4, 2010. Expanded Version: Young Mathematicians Conference, Ohio State, August 28, 2010. Updated Version: AMS Special Session on Undergraduate Research (joint with Murat Koloğlu), Holy Cross, April 9, 2011.

5. *Eigenvalue statistics for Toeplitz ensembles*, ICM Satellite Meeting in Probability & Stochastic Processes, Bangalore, India, August, 2010.

6. *Eigenvalue statistics for Toeplitz and circulant ensembles*, AMS Special Session on Random Processes, Holy Cross, MA, April 9, 2011.

7. *Painlevé VI and Tracy-Widom Distributions in Random Graphs, Random Matrix Theory and Number Theory*, AMS Special Session on Random Processes, Worcester, MA, 4/9/11.

8. *Distributions of Eigenvalues of Weighted, Structured Matrix Ensembles* (presented by Olivia Beckwith and Karen Shen), Young Mathematicians Conference, August 19, 2011.

9. *Distributions of Eigenvalues of Real Symmetric Period m–Circulant Matrices*, IMS Asia Pacific Rim Meetings, July 2011. (Postponed to 2012 due to Tsunami)

Analysis, (Additive) Number Theory, Probability and Statistics and Sabermetrics (see also the Benford's Law talks) (39)

1. *The Pythagorean Won-Loss Formula in baseball* (title changed to *Pythagoras at the Bat: an introduction to mathematical modeling* in later versions), Brown University, September 28, 2005; Hudson River Undergraduate Mathematics Conference, April 8, 2006; SABRBoston Sabermetrics Regional Meeting, May 20, 2006; Williams College, January 15, 2008; Holy Cross, February 7, 2008; Western New England College, February 12, 2008; Connecticut Smoky Joe Wood SABR Chapter, Hamden, CT, February 16, 2008; PROMYS, Boston University, July 25, 2008; Bennington College, February 27, 2009; Hampshire College, July 22, 2009; Awards Night at the University of Connecticut, April 12, 2010; Virginia Tech, March 28, 2011; UMass Amherst, October 19, 2011; Fitchberg State University, November 3, 2011.

2. *The Modulo* 1 *Central Limit Theorem*, Analysis Seminar, Brown University, September 27, 2006; The Ohio State University, January 23, 2007.

3. *When almost all sets are difference dominated*, Analysis Seminar, Brown University, September 12, 2007; Williams College, September 12, 2008; Wesleyan University, November 20, 2008; Workshop on Combinatorial and Additive Number Theory (CANT 2009), CUNY Graduate Center, New York, May 2009.

4. *Explicit constructions of infinite families of MSTD sets* (presented by Dan Scheinerman), Number Theory Session, Joint Mathematics Meetings, January 5, 2009.

5. *Cookie Monster Meets the Fibonacci Numbers. Mmmmmm – Theorems!*, Workshop on Combinatorial and Additive Number Theory (CANT 2010), CUNY Graduate Center, New York, May 29, 2010; Hampshire College, July 15, 2010; Hampshire College Summer Program (expanded version), July 15, 2010; Smith College, January 28, 2011; Pi Mu Epsilon Induction Ceremony, College of the Holy Cross, May 5, 2011; Amherst College, September 21, 2011; Brown University, October 24, 2011.

6. *From Fibonacci Numbers to Central Limit Type Theorems* (Yinghui Wang, presenter), SMALL progress report, August 4, 2010. Expanded version: Young Mathematicians Conference, Ohio State, August 28, 2010. Further expanded: Williams College Seminar, October 1, 2010.

7. *The Circle Method and Class Groups of Quadratic Fields* (Carlos Dominguez, presenter), SMALL progress report, August 4, 2010. Expanded Version: Young Mathematicians Conference, Ohio State, August 27, 2010.

8. *Cookie Monster Meets the Fibonacci Numbers, II. Mmmmmm – Theorems*, Workshop on Combinatorial and Additive Number Theory (CANT 2011), May 2011.

9. *Explicit Constructions of Generalized MSTD Sets* (joint with Sean Pegado and Sidney Luc Robinson), Workshop on Combinatorial and Additive Number Theory (CANT 2011), May 2011.

10. *Gaps between summands in generalized Zeckendorf decompositions* (presented by Olivia Beckwith), Young Mathematicians Conference, August 19, 2011.

11. *Constructing Generalized Sum-Dominant Sets* (presented by Geoff Iyer and Liyang Zhang), Young Mathematicians Conference, August 19, 2011; Maine-Quebec Number Theory Conference, University of Maine, October 1, 2011.

12. *The Distribution of Generalized Ramanujan Primes* (presented by Nadine Amersi and Ryan Ronan), Young Mathematicians Conference, August 20, 2011.

13. *The Distribution of the Number of Missing Sums in Sumsets* (presented by Oleg Lazarev), Young Mathematicians Conference, August 21, 2011.

14. *Distribution of Summands in Generalized Zeckendorf Decompositions, I* (joint with Yinghui Wang), Special Session on Difference Equations and Applications, AMS Special Session, George Washington University, March 17, 2012.

15. *Distribution of Summands in Generalized Zeckendorf Decompositions, II* (joint with Yinghui Wang), Special Session on Difference Equations and Applications, AMS Special Session, George Washington University, March 17, 2012.

Colloquium / General Talks (mostly Random Matrix Theory and Number Theory) (18)

1. *Random Matrices, Random Graphs, and L-Functions*, University of Cincinnati, October 16, 2003; Brown University, October 6, 2006; Yale University, November 14, 2006.

2. *From nuclear physics to number theory: How the Manhattan project helped us understand primes*, Symposium for Undergraduates in Mathematical Sciences, Brown University, February 12, 2005; Colby College, March 8, 2005; University of Connecticut, March 22, 2005; Bronfman Science Lunch, Williams College, June 23, 2009; Wellesley College, February 2, 2010.

3. *Heuristics and Ballpark Estimates: From the* $3x+1$ *problem to counting primes and birthdays*, PROMYS (Boston University), July 28, 2009.

4. *Pythagoras at the bat: An introduction to statistics and mathematical modeling*, Wellesley College, September 21, 2009; Boston College invited undergraduate lecture, Spring 2012.

5. *The Riemann Hypothesis at 150: From Primes to Nuclei and Many Things Between*, Williams College, Colloquium in honor of 150 years of RH, November 18, 2009.

6. *Title: How low can we go? Lower order terms in CLTs from Benford's Law to Elliptic Curves*, NES MAA Fall 2009 Meeting, November 21, 2009.

7. *From the Manhattan Project to Elliptic Curves*, Smith College, January 28, 2011.

8. *From Cookie Monster to the IRS: Some Fruitful Interactions between Probability, Combinatorics and Number Theory*, UNC Charlotte, 2/1/2011.

9. *Biases: From Benford's Law to Additive Number Theory via the IRS and Physics*, SMALL Summer REU, Williams College, June 22, 2011.

10. *Number Theory and Random Matrix Theory Progress Report* (joint with Nadine Amersi, Thealexa Becker, Olivia Beckwith, Geoffrey Iyer, Oleg Lazarev, Karen Shen, Alec Greaves-Tunnell, Ryan Ronan, Liyang Zhang). SMALL End of Summer Progress Report, Williams College, August 2, 2011.

11. *Virus dynamics on spoke and hub graphs* (presented by Thealexa Becker), WiMiN Conference, September 24, 2010.

Undergraduate Eduction (9)

1. *Computers in undergraduate education and zeros of elliptic curves*, Foundations of Computational Mathematics, Computational Number Theory Workshop, University of Minnesota, August 9, 2002; NSF Workshop on Computation in Algebra, Number Theory and Combinatorics, Washington, D.C., September 21, 2002.

2. *Statistical investigations as a tool in undergraduate mathematics research: Poster and workshop sessions*, International Conference on Statistics, Honolulu, June 4, 2003.

3. *What Is Mathematics?*, panelist at RUMBUS07, Boston University, November 10, 2007.

4. *What Can I Do With A Mathematics Major?*, panelist at the Northeastern Section of the Mathematical Association of America (NES/MAA) Fall 2007 meeting, Framingham State College, November 17, 2007.

5. *The Pythagorean Won-Loss Theorem: An introduction to modeling*, Great Activities for an Introductory Statistics Class, AMS National Meeting, San Diego, January 7, 2008.

6. Workshop on Mathematicians in Mathematics Education, participant, Institute for Mathematics Education, Tucson, Arizona: March 20 - 22, 2008 and April 25-27, 2010.

7. *Mentoring Undergraduate Research*, AMS Special Session on Undergraduate Research, Holy Cross, April 10, 2011.

Programming (2)

1. *Sage Days 21: Progress Report on Statistics in Function Fields*, Sage Days 21, Seattle, Washington, May 27, 2010.

2. *An Introduction to Matlab in Mathematics*, IAS Women in Mathematics Conference, May 18, 2011.

Undergraduate, Graduate and General Talks

1. Undergraduate Math Club Talks (Brown, Ohio State, Princeton and Yale). Topics include Benford's law, the circle method, cryptography, dynamical systems, mathematical riddles, the prime number theorem, probability and statistics, random matrix theory and sabermetrics.

2. Graduate Seminars (Brown, Princeton). Topics include the circle method, detecting and proving patterns, L-functions and automorphic forms, number theory, random matrix theory and sabermetrics.

3. General talks (to undergraduates, graduate students and postdocs). Topics include applying for postdocs and tenure track jobs, careers in mathematics, and using props in teaching.

Papers and Talks available online at http://www.williams.edu/Mathematics/sjmiller/

Education outreach activities

1. Invited participant: VCTAL - the computational thinking modules (designing modules to be used in high school math classes).

2. Invited participant: Institute for Mathematics & Education: Mathematicians in Mathematics Education Workshop: March 20-22, 2008 and April 25-27, 2010.

3. Frequent speaker at Hampshire College, Ross and PROMYS programs for talented high school students in mathematics, 2004 – present.

4. Write and review exam questions for the American Mathematics Competitions.

5. Maintain math riddles website, consistently in top ten when googling 'math riddles': `http://mathriddles.williams.edu/`. This leads to numerous conversations with mathematics educators about using riddles in the classroom. Working to expand the site to include material for high school and junior high school teachers and students.

6. Lecturer in the Teachers as Scholars program, where I gave continuing education lectures on cryptography and Benford's law, which an emphasis on creating modules for high school / junior high school classes.

Teaching Experience

Course evaluations

Course evaluations from Brown and Williams are available upon request. Course homepages online at `http://www.williams.edu/Mathematics/sjmiller/public_html/index.htm`

Guided Research Classes / Programs / Independent Studies

Williams	Independent study on Probability (Spring 2011, Winter 2011)
Williams	Independent study on Number Theory (Winter 2011)
Williams	Independent study on Cryptography (Winter 2011)
Williams	Independent study on the Putnam and Problem Solving (Fall 2010)
Williams	Independent study on sabermetrics (Winter 2011, Fall 2009, Fall 2008)
Williams	Independent study on differential equations (Spring 2009)
Brown	Math 197: undergraduate research class on Sabermetrics (2008), working on general problems and some projects for the San Diego Padres.
	Math 197: undergraduate research class on Benford's law (2007)
	Math 197: undergraduate research class on number theory and automorphic forms (2007);
	Math 197: undergraduate research class on cryptography (with Jill Pipher, 2006);
	Math 197: undergraduate research class on elliptic curves (2004–2005).
Ohio State	Program Director, Vertically Integrated Summer Program in Computational Number Theory (2004); Number Theory Working Group (with Vitaly Bergelson and Warren Sinnott, 2003–2004).
	Instructor, one week course on the circle method at the Ross Program, Summer 2004.
AIM	Vertically Integrated Summer Program in Computational Number Theory (with Brian Conrey, David Farmer, Chris Hughes & Michael Rubinstein, 2003).
Princeton	Designing and running the VIGRE Junior Research Seminar / Undergraduate Math Lab (with Peter Sarnak, Andrew Wiles, Ramin Takloo-Bighash, Yakov Sinai, 2000–2003).
NYU	Designing and running the VIGRE Undergraduate Math Lab at the Courant Institute, NYU (with Peter Sarnak and Alex Barnett, 2002).

Standard Classes

Graduate Linear Algebra	Ohio State (Summer 2004)
Analysis and Number Theory	Williams College (Spring 2009, Fall 2010)
Complex Analysis	Williams College (Fall 2010)
Probability	Williams College (Fall 2009)
	Mount Holyoke College (Fall 2011)
Abstract Algebra	Brown (Fall 2005 & 2006)
Mathematical Statistics	Brown (Spring 2005, 2006, 2007 & 2008)
Differential Equations and Vector Calculus	Williams College (Spring 2009)
Number Theory	Smith College (Fall 2011)
Discrete Mathematics	Ohio State (Summer 2003)
Honors Linear Algebra	Princeton (Spring 1999); Brown (Spring 2007)
Linear Algebra	Brown (Fall 2004)
Honors Problem Solving	Ohio State (Autumn 2003)
Honors Vector Calculus	Brown University (Fall 2007)
Multivariable Calculus	Williams College (Spring 2010, Spring 2011)
Freshman Seminar (From Riddles to Modern Mathematics)	Brown (Spring 2006)
Reading Classics Working Group	Ohio State (with Vitaly Bergelson and Warren Sinnott, 2003–2004)
Calculus I	Princeton (Summer 1999, 2000 & 2002); Brown (Fall 2004, Summer 2005, 2006, 2007 & 2008) Williams (Fall 2008)
Introduction to Cryptography	Williams (Winter 2010)
Fundamentals of College Algebra	Ohio State (Autumn 2003)
Basic College Mathematics	Ohio State (Autumn 2003)

Advising Experience

I have supervised almost 200 undergraduate and graduate students in research projects and programs since 2000, many of which have led to publications, conference presentations, fellowships and awards, and have been active in numerous undergraduate math clubs. Below are some representative examples of activities.

2008 - present	Faculty advisor to the Green Chicken / Math Puzzle Night / Math Team at Williams.
2011	Faculty mentor to 9 undergraduates in SMALL math research program (summer, Williams).
2010	Faculty mentor to 6 undergraduates in SMALL math research program (summer, Williams).
2010	Research mentor to 6 PROMYS students (summer, Boston University).
2010	Faculty mentor to 3 students for WIT under OIT's auspices (summer, Williams).
2009	Faculty mentor to 6 undergraduates in SMALL math research program (summer, Williams).
2009	Research mentor to 7 PROMYS students (summer, Boston University).
2004 - 2008	Advisor to the Brown University Undergraduate Mathematics Club and faculty advisor for Brown University's Symposium for Undergraduates in Mathematical Sciences.
2003 - 2004	Advisor to the Ohio State Undergraduate Mathematics Club and the Putnam team.

2010 - 2011: Williams College: Thesis advisor: Ari Binder (graph theory), Jake Levinson (number theory and random matrix theory), Wentao Xiong (random matrix theory); secondary advisor to Dan Costanza (economics). Faculty advisor to 6 colloquium talks: Dan Costanza (statistics); Elliot Schrock (number theory); David Phillips (juggling); Leah Hurwich (number theory); Ari Binder (probability); Vincent Pham (linear programming).

2009 - 2010: Williams College: Thesis advisor: Ralph Morrison (number theory and random matrix theory). Ran an independent study (5 students) on sabermetrics. Faculty advisor to 7 colloquium talks: Christophe Dorsey: graph theory; Corey Watts: chaos theory; Noel MacNaughton: Ramsey theory. Crosby Fish: Benford's law; Adam Capulong: Kelly criterion for optimal gambling; Michael Grover: Josephus problem (probability); Jaehong Cho: Zipf's law (probability).

2008 - 2009: Williams College: Advised one undergraduate investigation in sabermetrics and two in differential equations. Advisor to 6 colloquium talks: Chris Chiang: sabermetrics; Rich McDowell: Benford's law; Mary Feeley: linear programming; David Aitoro: Monster Group; Eric Moore: Probability; Jake Gorelov: Game Theory.

2007 - 2008: Brown University: Advised one undergraduate investigation on elliptic curves and L-functions, one on random graphs, four on Benford's Law, ten on sabermetrics, and one senior on the mathematics of bridge bidding conventions. Faculty advisor to 24 undergraduates (5 juniors, 14 sophomores, 5 freshmen). Over the summer advised one undergraduate research project in additive number theory (which was given a named grant by Brown), and two students in a mathematics education project to design handouts and web applets for introductory calculus (joint with Professor Tom Banchoff).

2006 - 2007: Brown University: On the dissertation defense committee for Michelle Manes (Number Theory). Advised five undergraduate investigations in the circle method, continued fractions, dynamical systems, random graphs and probability. Faculty advisor to 18 undergraduates.

2005 - 2006: Brown University: On the dissertation defense committee for Alina Bucur (Number Theory) and Minh Quang (Analysis).
Advised four undergraduate investigations in random matrix theory, prime numbers, iterative functions and probability. Faculty advisor to 5 undergraduates.

2004 - 2005: Princeton University: co-advised 1 senior dissertation.
Brown University: advised five undergraduate investigations in elliptic curves and random matrix theory.

2003 - 2004: Princeton University: co-advised 1 senior dissertation.
American Institute of Mathematics: co-advised 8 summer undergraduate research projects.
The Ohio State University: co-advised 7 undergraduate / graduate research projects during the year, 10 over the summer.

2002 - 2003: Princeton University: co-advised 17 junior research projects in fall, 16 in spring; co-advised 3 senior dissertations.
Courant Institute, NYU: co-advised 3 junior research projects.

2001 - 2002: Princeton University: co-advised 11 junior research projects, co-advised 1 senior dissertation.

2000 - 2001: Princeton University: co-advised 8 junior research projects.

Computer Skills

1. Ran the VIGRE Undergraduate Mathematics Laboratory four times at Princeton, once at the Courant Institute, NYU, twice at Ohio State, and a similar program at the American Institute of Mathematics (summer 2003). Duties included helping undergraduates and graduate students investigate hot conjectures numerically and theoretically; responsible for coding and algorithm help in C, PARI, Mathematica, Maple, Matlab.

2. Graduate Liaison and Residential Computer Consultant for Computer and Information Technology at Princeton (two years).

3. I am able to LaTeX mathematical lectures in real-time. This has allowed me to post complete course notes for several undergraduate and graduate classes at Princeton, NYU and Ohio State, as well as many conferences; see, for example, the 2009 Graduate Workshop on Zeta Functions, L-Functions and their Applications:
`http://www.williams.edu/Mathematics/sjmiller/public_html/ntandrmt/index.htm`

Miscellaneous

2006 - present:	Contacted by an instructor at the Internal Revenue Service Criminal Investigation's National CI ăTraining Academy to discuss applications of Benford's law to corporate fraud detection. Talked (2008) to agents of the IRS's Boston office on the theory & application of Benford's law. Currently have the IRS reviewing a new method to detect tax fraud.
2009 - present:	Maintaining webpage with extensive notes, talks and programs for graduate students interested in L-functions and Random Matrix Theory. `http://www.williams.edu/Mathematics/sjmiller/public_html/ntandrmt/index.htm`
2008 - 2011:	Wrote problems for AMC 8 math competition (thrice), AMC 12 (once); Proof-read problems for the AMC 12 math competition.
2004 - 2008:	Frequent panelist in graduate teaching workshops at Brown.
1998 - present:	Maintain math riddles website, consistently in top ten when googling 'math riddles': `http://mathriddles.williams.edu/`

Williams College Service

2010 - 2011:	Member Ad Hoc Dining Committee (chair of Whitmans subcommittee).
2010 - 2011:	Faculty Programming Director (Spencer Neighborhood).
2010 - 2011:	Faculty mentor to a WIT group (under OIT's auspices).
2009 - 2010:	Member Ad Hoc Advising Committee (chair of transfer student subcommittee).
2008 - 2009:	Member of Math/Stats Department Search Committee.
2008 - present:	Frequent participant in recruiting activities, worked with Admissions.

Referee Service (81 papers, 39 journals, 1 conference proceedings)

1. Abstract and Applied Analysis (3)
2. Acta Arithmetica (1)
3. Acta Mathematica (1)
4. Advances in Difference Equations (2)
5. Albanian Journal of Mathematics (1)
6. Algebra & Number Theory (1)
7. American Mathematical Monthly (8)
8. Annals of Mathematics (2)
9. Applied Mathematics and Computation (1)
10. Aquatic Botany (1)
11. Canadian Journal of Mathematics (1)
12. Communications in Algebra (1)
13. Communications in Number Theory and Physics (1)
14. Compositio Mathematica (4)
15. Crelle's journal: Journal für die reine und angewandte Mathematik (1)
16. Duke Mathematical Journal (2)
17. Electronic Communications in Probability (1)
18. Experimental Mathematics (2)

19. Fibonacci Quarterly (2)
20. Hacettepe Journal of Mathematics and Statistics (1)
21. INTEGERS (1)
22. International Journal of Mathematics and Mathematical Research (1)
23. International Journal of Number Theory (1)
24. International Mathematics Research Notes (3)
25. ISRN Computational Mathematics (1)
26. Journal of the American Mathematical Society (1)
27. Journal of the Indian Statistical Association (1)
28. Journal of the London Mathematical Society (1)
29. Journal of Number Theory (18)
30. Journal of Physics A: Mathematical and General (1)
31. Journal of the Ramanujan Mathematical Society (1)
32. Journal of Theoretical Probability (3)
33. Linear Algebra and its Applications (1)
34. London Mathematical Society (1)
35. Mathematics Magazine (2)
36. Physica A: Statistical Mechanics and its Applications (1)
37. Proceedings of the XIVth International Conference on Fibonacci numbers (1)
38. Proceedings of the National Academy of Sciences of the United States of America (1)
39. Proceedings of the Royal Society A: Mathematical, Physical and Engineering Sciences (1)
40. Statistics and Probability Letters (2)

Review Service: 6 research proposals

1. Research proposal for CUNY (2004).
2. Research proposal for the NSA (2008).
3. Research proposal for the NSA (2010).
4. Research proposals (2) for the NSA (2011).
5. Research proposal for the Swiss National Science Foundation (2011).
6. Panelist for the NSF in Analysis, Number Theory and Combinatorics.

Review Service: 118 papers for Mathematical Review (MathSciNet)

Review Service: Book Reviews

1. E. Bombieri and W. Gubler, *Heights in Diophantine Geometry*, book review for Siam Review.

2. P. Borwein, S. Choi, B. Rooney and A. Weirathmueller (editors). The Riemann hypothesis. A resource for the afficionado and virtuoso alike. CMS Books in Mathematics/Ouvrages de Mathématiques de la SMC. Springer, New York, 2008, book review for MathSciNet.

3. P. Forrester, *Log-gases and random matrices*, London Mathematical Society Monographs Series, 34. Princeton University Press, Princeton, NJ, 2010. xiv+791 pp. Book review for MathSciNet (review joint with Eduardo Dueñez).

Review Service: (6) Book Proposals

1. S. S. Epp, *Discrete Mathematics with Applications*, third edition, Thomson $*$ Brooks/Cole, review to help revise the book for the fourth edition.

2. J. E. Marsden and A. J. Tromba, *Vector Calculus*, fifth edition, W. H. Freeman, review of content and presentation.

3. Book proposal for John Wiley & Sons.

4. Book proposal for Cambridge University Press.

5. Book proposal for CRC Press.

6. Book proposal for McGraw-Hill.