

Deepak C. Bal

- CONTACT INFORMATION** Department of Mathematical Sciences *Phone: (973) 655-3936*
Montclair State University *e-mail: deepak.bal@montclair.edu*
Montclair, NJ 07043 *web: <http://msuweb.montclair.edu/~bald>*
- RESEARCH INTERESTS** Probabilistic combinatorics. Random Graphs and Hypergraphs. Colorings, Hamiltonicity, matchings, Ramsey Theory. Analysis of discrete random processes.
- EXPERIENCE** Sept 2015 - Present. Assistant Professor, Department of Mathematical Sciences, Montclair State University
- Sept 2014 - Sept 2015. Visiting Assistant Professor, Department of Mathematics, Miami University.
- Sept. 2013 - Sept 2014. Postdoctoral Research Fellow, Department of Mathematics, Ryerson University. Supervised by Dr. Anthony Bonato and Dr. Pawel Pralat.
- EDUCATION** **Carnegie Mellon University**, Pittsburgh, Pennsylvania USA
- Ph.D., Algorithms, Combinatorics and Optimization, May 2013
- Dissertation Topic: “Colorings, Matchings and Packings in Random and Pseudo-Random Graphs”
 - Advisor: Alan Frieze
- M.S., Algorithms, Combinatorics and Optimization, May 2010
- The Ohio State University**, Columbus, Ohio USA
- B.S., Mathematics, June 2008
B.S., Computer Science, June 2008
- PUBLICATIONS** For preprints of all papers please visit <http://msuweb.montclair.edu/~bald/research>
- Accepted and Published papers**
1. *The bipartite $K_{2,2}$ -free process and bipartite Ramsey number $b(2, t)$*
(Co-Author: P. Bennett) To appear in Electronic Journal of Combinatorics (2020).
 2. *Hamiltonian Berge Cycles in Random Hypergraphs*
(Co-Authors: R. Berkowitz, P. Devlin, M. Schacht) To appear in Combinatorics, Probability and Computing (2020).
 3. *Zero Forcing Number of Random Regular Graphs*
(Co-Authors: P. Bennett, S. English, C. MacRury, P. Pralat) To appear in Journal of Combinatorics (2020).
 4. *A Note on a Candy Sharing Game*
(Co-Author: J. DeGaetani (MSU student)) To appear in The Art of Discrete and Applied Mathematics (2020).
 5. *A Ramsey Property of Random Regular and k -out Graphs*
(Co-Author: M. Anastos) Journal of Graph Theory 93 (2020) 363-371.
 6. *A greedy algorithm for finding a large 2-matching on a random cubic graph.*
(Co-Authors: P. Bennett, T. Bohman, A. Frieze) Journal of Graph Theory 88 (2018) 449-481.

7. *Partitioning random graphs into monochromatic components*
(Co-Author L. DeBiasio) The Electronic Journal of Combinatorics 24 (2017), no. 1, Paper 1.18, 25 pp.
8. *Rainbow perfect matchings and Hamilton cycles in the random geometric graph.*
(Co-Authors: P. Bennett, X. Perez Gimenez, P. Pralat) Random Structures Algorithms 51 (2017), no. 4, 587–606.
9. *The Total Acquisition Number of Random Graphs.*
(Co-Authors: P. Bennett, A. Dudek, P. Pralat) The Electronic Journal of Combinatorics 23 (2016), no. 2, Paper 2.55.
10. *Lazy Cops and Robbers Played on Random Graphs and Graphs on Surfaces.*
(Co-Authors: A. Bonato, W.B. Kinnersley, P. Pralat) Journal of Combinatorics 7 (2016) no. 4, 627-642.
11. *Rainbow Arborescence in Random Digraphs.*
(Co-Authors: P. Bennett, C. Cooper, A. Frieze, P. Pralat) Journal of Graph Theory 83 (2016), no. 3, 251-265
12. *Rainbow Matchings and Hamilton Cycles in Random Graphs.*
(Co-Author: A. Frieze) Random Structures and Algorithms 48 (2016) no. 3, 503-523.
13. *Power of k -choices and Rainbow Spanning Trees and Random Graphs.*
(Co-Authors: P. Bennett, A. Frieze, P. Pralat) The Electronic Journal of Combinatorics 22 (2015), no. 1, Paper 1.29, 22 pp.
14. *Lazy Cops and Robbers on Hypercubes.*
(Co-Authors: A. Bonato, W.B. Kinnersley, P. Pralat) Combinatorics, Probability and Computing 24 (2015), no. 6, 829-837.
15. *Packing Tree Factors in Random and Pseudo-Random Graphs.*
(Co-Authors: A. Frieze, M. Krivelevich, P. Loh) The Electronic Journal of Combinatorics 21, 2014, P2.8.
16. *The t -tone chromatic number of random graphs.*
(Co-Authors: P. Bennett, A. Dudek, A. Frieze) Graphs and Combinatorics 30 (2014), no. 5, 1073-1086
17. *Packing tight Hamilton cycles in uniform hypergraphs*
(Co-Author: A. Frieze) SIAM Journal on Discrete Mathematics 26, 2012, 435-451.
18. *On the Maximum Number of Edges in a Hypergraph with a Unique Perfect Matching.*
(Co-Authors: A. Dudek, Z. Yilma) Discrete Mathematics 311, 2011, 2577-2580.
19. *Graph Connectivity, Partial Words, and a Theorem of Fine and Wilf.*
(Co-Authors: F. Blanchet-Sadri, G. Sisodia) Information and Computation 206, 2008, 676-693.

Submitted papers

1. *On the size Ramsey number of all cycles versus a path*
(Co-Author: Ely Schudrich (MSU Student)) Submitted to Discrete Mathematics.
2. *New lower bounds on the size-Ramsey number of a path*
(Co-Author: L. DeBiasio) Submitted to Journal of Graph Theory.
3. *The Random Matching and Independent Set Processes in Random Graphs and Hypergraphs with a given degree sequence*
(Co-Author: P. Bennett) A synthesis of two manuscripts. To be submitted shortly.

Other writings

1. *On Sharp Thresholds of Monotone Properties: Bourgain's Proof Revisited.* Exposition of a proof of Bourgain (2012)

2. *Leibniz, Bernoulli and the Logarithms of Negative Numbers*. Written for the Reading Classics VIGRE Working Group at Ohio State Univ., Spring 2006

MENTORING
EXPERIENCE

Master's Theses advised

1. Ely Schudrich, 5 year B.S/M.S. Mathematics (expected graduation December 2020). *Bipartite, size and online Ramsey numbers of some cycles and paths*
2. Joseph DeGaetani, M.S. Pure and Applied Mathematics (graduated 2018). *Candy Sharing and Chip Firing Games on Graphs*
3. Adam Catisano, M.S. Pure and Applied Mathematics (graduated 2018). *The Dispersion Process for Particles on Graphs*

Master's Capstones advised

1. Amanda Lee Phillips (joint advised with Jon Cutler), M.S. Mathematics (graduated 2020). *Branches of the Ramsey Tree*

Undergraduate and High School Student Research Advised

1. Sarah Acquaviva (2020-present) *Using the Julia language to model and study the Montclair State student network*
2. Ricky Wilde (2020 - present) *The Full-degree spanning tree problem in bounded degree graphs*
3. Gregory Pylypovych (High School student) (2018-2019) *Random processes on graphs*
4. Joao Paulo Dos Santos Ferreira (2018-2019) SHIP Program participant. *Machine Learning and Combinatorial Algorithms*
5. Patrick Palka (2016-2018). SHIP Program participant. *Asymmetric Random Sequential Adsorption*

Master's Thesis Committees

- Daniel Arabia (2020)
- Jhonny Alameida (2018)
- Giancarlo Labruna (2018)

TEACHING
EXPERIENCE

Montclair State University, Montclair, NJ USA

Course Instructor

Responsible for planning lectures, writing tests as well as grading.

- Autumn 2020 (current).
 - MATH 102 New Student Experience (19 students)
 - MATH 122 Calculus I (2 sections) (40 + 39 students)
- Spring 2020.
 - MATH 221 Calculus II (2 sections) (39 + 34 students)
 - MATH 485 Applied Combinatorics and Graph Theory (18 students)
- Autumn 2019.
 - MATH 221 Calculus II (38 students)
 - MATH 431 Modern Algebra (22 students)
- Spring 2019.
 - MATH 221 Calculus II (2 sections) (21+35 students)
 - MATH 581 Graph Theory (Graduate course) (17 students)

- Autumn 2018.
 - MATH 221 Calculus II (28 students)
 - MATH 485 Applied Combinatorics and Graph Theory (19 students)
- Spring 2018.
 - MATH 221 Calculus II (36 students)
 - MATH 431 Modern Algebra (30 students)
- Autumn 2017.
 - MATH 221 Calculus II (2 sections) (29+33 students)
 - MATH 580 Combinatorial Mathematics (Graduate course) (24 students)
- Spring 2017.
 - MATH 221 Calculus II (30 students)
 - MATH 431 Modern Algebra - 2 sections (16 + 25 students)
- Autumn 2016.
 - MATH 221 Calculus II (31 students)
 - MATH 485 Applied Combinatorics and Graph Theory (31 students)
- Spring 2016
 - MATH 122 Calculus I - 2 sections (32+29 students)
- Fall 2015
 - MATH 122 Calculus I - 2 sections (30 + 32 students)

Miami University, Oxford, Ohio USA

Course Instructor

Responsible for planning lectures, writing tests as well as grading.

- MTH151 Calculus I, Autumn 2014 (2 sections, approximately 45 students each).
- MTH251 Calculus II, Spring 2015 (2 sections).

Ryerson University, Toronto, Ontario Canada

Course Instructor

Responsible for course design, writing tests as well as grading.

- MTH607 Graph Theory, Winter 2014 (approximately 60 students).

Advising

Co-advising (with A. Bonato) undergraduate student Xindi Wang in Random Graphs and Networks as part of Mitacs Globalink Program.

Carnegie Mellon University, Pittsburgh, Pennsylvania USA

Course Instructor

Responsible for course design, writing tests as well as grading.

- 21-256 Multivariate Analysis, Summer 2009
- 21-260 Models and Methods of Optimization, Summers 2010 and 2012

Teaching Assistant

- TA for 6 different courses including Calculus, Discrete Math, Optimization, Differential Equations and Multivariable Calculus. Responsible for teaching recitations and grading tests and homeworks.

- Calculus TA for the Summer Academy for Math and Science (SAMS) Summer 2013 at Carnegie Mellon University. SAMS is a residential summer program for high school students meant to promote diversity in the ranks of outstanding college-bound students interested in STEM fields.

TALKS

Invited Talk at Western Michigan University Graph Theory Seminar “Hamilton Berge cycles in random hypergraphs” (January 2020)

Invited Talk at United States Naval Academy Combinatorics and Topology seminar “The size Ramsey number of paths” (November 2019)

Invited Talk at Yale University Combinatorics Seminar “The size Ramsey number of paths” (October 2019)

Talk at New York Combinatorics Seminar “The size Ramsey number of paths” (October 2019)

Invited Talk at AMS Spring Sectional (Auburn, AL) “Berge Hamiltonian cycles in random hypergraphs” (April 2019)

Talk at Montclair State Math Club “What are the Chances” (April 2019)

Invited Talk at Western Michigan University Graph Theory Seminar “Zero forcing number of random regular graphs.” (February 2019)

Talk at MAA-NJ Fall Meeting, Session on Graph Theory “Berge Hamiltonian cycles in random hypergraphs.” (October 2018)

Talk at SIAM Conference on Discrete Mathematics Minisymposium on Discrete Random Processes “The bipartite $K_{2,2}$ -free process and Ramsey numbers.” (June 2018)

Invited Talk at AMS Spring Sectional (Boston, MA) “The bipartite $K_{2,2}$ -free process and Ramsey numbers.” (April 2018)

Invited Talk at Graph Theory Day 75 (Brooklyn College, CUNY) “Monochromatic Components in Random Graphs” (April 2018)

Invited Talk at AMS Spring Sectional 2018 (Columbus, OH) “The bipartite $K_{2,2}$ -free process and Ramsey numbers.” (March 2018)

Invited Talk at Miami University (Oxford, OH) Mathematics Department Colloquium “Dynamic Concentration and Bipartite Ramsey Numbers” (March 2018)

Montclair State University Department of Mathematical Sciences Colloquium “Monochromatic Structures in Edge-Colored Random Graphs” (February 2018)

Invited Talk at Rutgers Discrete Math Seminar “Monochromatic Structures in Random Graphs” (October 2017)

Invited Talk at AMS Fall Sectional 2017 (Buffalo, NY) Special Session on Advanced Techniques in Graph Theory. “Monochromatic Components in Random Graphs” (September 2017)

Random Structures and Algorithms 2017 (Gnieszno, Poland). “Monochromatic Components

in Random Regular and k -out Graphs” (August 2017)

Canadian Discrete and Algorithmic Mathematics - CanaDAM (Toronto, ON, Canada). “Analysis of the 2GREEDY algorithm on random graphs with a prescribed degree sequence.” (June 2017)

Plenary Talk at Graph Theory Day 73 (Brooklyn, NY). “Rainbow Structures in Random Graphs.” (April 2017)

Invited Talk at 4th Lake Michigan Workshop on Combinatorics and Graph Theory (Kalamazoo, MI). “Rainbow Structures in Random Graphs.” (April 2017)

Invited talk at AMS Spring Sectional 2017 (Bloomington, IN) Special Session on Probabilistic Methods in Combinatorics. “Improved analysis of the 2GREEDY algorithm on random graphs with a prescribed degree sequence.” (April 2017)

Invited talk at SIAM DM16 (Atlanta, GA) Minisymposium on Monochromatic Covering and Ramsey-Type Problems. “Monochromatic Covers and Partitions of Random Graphs” (June 2016)

Invited talk at AMS Spring Sectional 2016 (Fargo, ND) Special Session on Topics on Probabilistic and Extremal Combinatorics. “The random greedy Algorithm in Random Regular Hypergraphs” (April 2016)

Invited talk at Emmanuel College, Boston, MA “The Probabilistic Method” (April 2016)

New York Combinatorics Seminar (CUNY Graduate Center). “Monochromatic Covers and Partitions of Random Graphs” (October 2015)

Invited talk at AMS Fall Sectional 2015 (Loyola) Special Session on Topics in Graph Theory, Hypergraphs and Set Systems. “Rainbow Structures in Random Graphs” (October 2015)

Random Structures and Algorithms 2015. “Monochromatic Covers and Partitions of (Pseudo) Random Graphs” (July 2015)

Invited talk Ohio State University Combinatorics and Probability Seminar “Monochromatic Cycle Partitions of Random Graphs” (April 2015)

Invited talk at AMS Central Spring Sectional Meeting 2015 (Michigan State) Special Session on Extremal Graph Theory: Hypergraphs, Directed Graphs, and Other Generalizations. “Monochromatic Cycle Partitions of Random Graphs” (March 2015)

Miami University Graph Theory Seminar. “Random Colorings of Random Graphs.” (September 2014)

2014 SIAM Conference on Discrete Mathematics. Invited talk at mini-symposium on “Pursuit Games on Graphs.” (June 2014)

Ontario Combinatorics Workshop, York University. “The Total Acquisition Number of Random Graphs” (May 2014)

G@R Seminar, Ryerson University. “Rainbow Matchings and Hamilton Cycles in Random Graphs” (Dec. 2013)

Canadian Discrete and Algorithmic Mathematics - CanaDAM (Jun. 2013)

Ottawa Carleton Discrete Mathematics Days (May 2013)

54th Midwest Graph Theory Conference - MIGHTY LIV. "Packing Tree Factors in Pseudo-Random Graphs" (Apr. 2013)

Portland State University. Invited talk "Random and Pseudo-Random Graphs" (Feb. 2013)

Western Michigan University. Invited Graph Theory Seminar. "The 2-tone chromatic number of random graphs" (Jan. 2013)

Algorithms, Combinatorics and Optimization Seminar, Carnegie Mellon University. "Packing tight Hamilton cycles in uniform hypergraphs" (2012)

Graduate Student Seminar, Carnegie Mellon University. 5 talks:

- "Random and Pseudo-Random Graphs" (2013)
- "0-1 laws for random graphs" (2012)
- "Normal numbers" (2012)
- "The maximum number of edges in a hypergraph with a unique perfect matching" (2011)
- "The probabilistic method" (2011)

ACO Graduate Student Seminar, Carnegie Mellon University "Packing tight Hamilton cycles in hypergraphs" (2012)

Summer Undergraduate Applied Mathematics Institute, Carnegie Mellon University. "Ramsey Theory" (2012)

PROFESSIONAL
SERVICE

Montclair State University

Coach of Montclair State University Putnam Team (2016-present)

Department Scholarship Committee (2015-present)

Department Undergraduate Curriculum Committee (2017-2019)

Department Course Scheduling Committee (2019-present)

Applied Math Search Committee (2016)

Poster judge and session moderator for Undergraduate Student Research Symposium and CSAM Sigma Xi Symposium (2017 - 2019)

At-Large senator in University Senate. Serving on Student Affairs committee (2018-Present)

Office of Faculty Advancement Teaching Principles Committee. Faculty Advisory board for OFA (2020-present)

Mathematical Community

Co-organizer New York Combinatorics Seminar held approximately once a week at CUNY Graduate Center, New York, NY. 2016-present

MAA-NJ Vice Chair for Student Affairs 2018-present

Co-Director of the Garden State Undergraduate Mathematics Conference (GSUMC). Annual conference for undergraduates consisting of a competition, a poster session, talks by students and a plenary lecture by a noted mathematician. 2018-present

Co-Organizer (with Patrick Bennett and Lutz Warnke) “Minisymposium on Random Discrete Structures” at SIAM Conference on Discrete Mathematics June 2020 (postponed to unknown date), Portland, OR.

Co-organized (with Patrick Bennett) “Minisymposium on Discrete Random Processes” at SIAM Conference on Discrete Mathematics, June 2018, Denver, CO.

Co-organized (with Jon Cutler and Jozef Skokan) “Special Session on New Developments in Graphs and Hypergraphs” at Fall 2016 Eastern Sectional Meeting of the AMS, September 2016, Brunswick, ME.

Refereed articles for Journal of Combinatorial Theory Series B, Random Structures and Algorithms, Combinatorica, Combinatorics Probability and Computing, Journal of Graph Theory, SIAM Journal on Discrete Mathematics, Discrete Mathematics, Ars Combinatoria, Discrete Applied Mathematics, Discussiones Mathematicae Graph Theory, Internet Mathematics, CPAIOR, SIROCCO, WAW

Reviewer for MathSciNet Mathematical Reviews

Presentation judge (online video presentations by high schoolers) for New Jersey Academy of Science Spring 2020

Poster Judge for GS-LSAMP Fall conference 2018

Grader for NJ Undergraduate Mathematics Competition 2018

Academic Mentor for Street Squash Newark program (Fall 2015)

AWARDS, GRANTS, HONORS ETC. Received \$2,400 Separately Budgeted Research Award FY 2019 from Montclair State Office of Research and Sponsored Programs.

Participant in Engaged Teaching Fellows Program AY 2019-20

Received \$10,000 from Coca-Cola Foundation to fund Mathematical Sciences Colloquium Series at Montclair State

Received \$1,000 travel funding to attend Workshop on Random Geometric Graphs and Their Applications to Complex Networks, Fields Institute, Toronto, ON, June 2017

Departmental support at Carnegie Mellon (non-teaching): Fall 2009, Summer 2011, Fall 2012, Spring 2013.

Graduated Magna Cum Laude with Honors from Ohio State University.

O’Connell Computer Science Scholarship 2007-2008 at Ohio State University.

Lubrizol Foundation Math Scholarship at Ohio State University.

Math Scholarship Recipient 2005-2007 at Ohio State University.

Research 2 Research Undergraduate Research Grant Summer 2007.

Participant in REU at University of North Carolina at Greensboro Summer 2006.

National Merit Scholarship Finalist.

ASSOCIATION
MEMBERSHIPS

Member American Mathematical Society

Member Mathematical Association of America

Phi Beta Kappa

COMPUTER SKILLS

Proficient in Java. Experience with Python (including scikit-learn package), MATLAB, R, Mathematica, MySQL.