

Karen Meagher

Department of Mathematics and Statistics, University of Regina
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Current Position **Acting Associate Dean, Faculty of Graduate Studies and Research,**
University of Regina, Jan 1, 2017 - present.

Associate Professor, University of Regina July 1, 2007 - present.
Department of Mathematics and Statistics
3737 Wascana Drive, Regina, Saskatchewan, Canada.

Research Interests **Extremal Set Theory:** generalizations and extensions of the Erdős-Ko-Rado theorem, extension of results in extremal set theory to partition systems
Algebraic Graph Theory: applying methods from algebraic graph theory to design theory problems, problems involving eigenvalues of graph
Design Theory: constructions and bounds of covering arrays and orthogonal arrays

Education

Ph.D. **MATHEMATICS, University of Ottawa**
May/02 – Sept./05
Advisors: Lucia Moura, University of Ottawa
Brett Stevens, Carleton University
Thesis: *Covering arrays on graphs: qualitative independence graphs and extremal set-partition theory.*
This thesis was awarded the Ottawa-Carleton Institute for Mathematics and Statistics Ph.D. prize and the Pierre Laberge Doctoral prize.

M.Math. **PURE MATHEMATICS, University of Waterloo**
Sept./95 – May/97
Advisor: Kathryn Hare, University of Waterloo
Thesis: *Convolution Estimates with Orlicz Spaces.*

Honours B.Sc. **MATHEMATICS, University of Alberta**
Sept./91 – Apr./95

Research Experience

Oct. 05 – May 07 **NSERC Postdoctoral Fellow**, University of Waterloo, Waterloo, ON.
Advisor: Chris Godsil

Nov. 99 – Jul. 01 **Research Assistant** Simon Fraser University, Vancouver, B.C. Programmer and coordinator with Mathematics of Information Technology and Complex Systems (MITACS)

Research Publications

Books

1. Chris Godsil and Karen Meagher. Erdős-Ko-Rado Theorems: Algebraic Approaches. Cambridge University Press, 2016, 350 pages.

Journal Articles

2. Ferdinand Ihringer and Karen Meagher. Miklós-Manickam-Singhi Conjectures on Partial Geometries. To appear *Combinatorica*, July 2017.
3. Chris Godsil and Karen Meagher. An algebraic proof of the Erdős-Ko-Rado theorem for intersecting families of perfect matchings. To appear *Ars Mathematica Contemporea*, July 18, 2016.
4. Karen Meagher, Pablo Spiga and Pham Huu Tiep. An Erdős-Ko-Rado theorem for finite 2-transitive groups. *European J. Combin.* 55, 100-118, 2016.
5. Peter Borg and Karen Meagher. The Katona cycle proof of the Erdős-Ko-Rado theorem and its possibilities. *J. Algebraic Combin.* 43(4), 915-939, 2016.
6. Shaun Fallat, Karen Meagher and Boting Yang. On the Complexity of the Positive Semidefinite Zero Forcing Number. *Linear Algebra and its Applications*, 491(15) 101–122, 2016.
7. Karen Meagher and Alison Purdy. Intersection theorems for multisets. *European Journal of Combinatorics*, 52, 120–135, 2016.
8. Peter Borg and Karen Meagher. Intersecting generalised permutations. *Australasian Journal of Combinatorics*. 61, 147–155, 2015.
9. Bahman Ahmadi and Karen Meagher. The Erdős-Ko-Rado property for some 2-transitive groups. The Erdos-Ko-Rado property for some 2-transitive groups. *The Annals of Combinatorics*. 19(4), 621–640, 2015.
10. Adam Dyck and Karen Meagher. An Erdős-Ko-Rado theorem for subset partitions. *Involve, a Journal of Mathematics* 8(1) 119–127, 2015.
11. Bahman Ahmadi and Karen Meagher. The Erdős-Ko-Rado property for some permutation groups. *The Australasian Journal of Combinatorics*. vol.61, p.23, 2015.
12. Karen Meagher and Pablo Spiga. An Erdős-Ko-Rado theorem for the derangement graph of $\text{PGL}_3(q)$ acting on the projective plane. *SIAM Journal on Discrete Mathematics* 28(2) 918–941, 2014.
13. Fatemeh Alinaghipour Taklimi, Shaun Fallat and Karen Meagher. On the Relationships between Zero Forcing Numbers and Certain Graph Coverings. *Special Matrices* 2, 30–45, 2014.
14. Bahman Ahmadi, Fatemeh Alinaghipour, Michael S. Cavers, Shaun Fallat, Karen Meagher and Shahla Nasserassr. Minimum number of distinct eigenvalues of graphs. *Electronic Journal of Linear Algebra*. 26, Article 45. pp. 21, 2014.
15. Bahman Ahmadi and Karen Meagher. A new proof for the Erdős-Ko-Rado Theorem for the alternating group. *Discrete Mathematics*. 324(6) 28–40, 2014.
16. P. C. Li and K. Meagher. Sperner Partition Systems. *Journal of Combinatorial Designs* no. 7, 267–279, 2013.
17. R. Bailey, J. Caceres, D. Garijo, A. Gonzalez, A. Marquez, K. Meagher and M. Puertas. Resolving sets in Johnson and Kneser graphs. *European Journal of Combinatorics*. 34(4) 736–751, 2012
18. B. Ahmadi, F. Alinaghipour, S. Fallat, Y. Fan, K. Meagher and S. Nasserassr. The minimum rank of universal adjacency matrices. *Linear Algebra and its Applications*. 437 no. 8, 2064–2076, 2012
19. K. Meagher and A. Purdy. EKR for multsets. *Electronic Journal of Combinatorics* 18(1) Paper 220, 8 pp. 2011.

20. R. Bailey, A. Burgess, M. Cavers and K. Meagher. Generalized covering designs and clique coverings. *Journal of Combinatorial Designs* 19, 378–406, 2011.
21. R. Bailey and K. Meagher. On the metric dimension of Grassman graphs. *Discrete Math and Theoretical Computer Science*, 13(4), 97–104, 2011.
22. K. Meagher and P. Spiga. An Erdős-Ko-Rado theorem for the derangement graph of $PGL(2, q)$ acting on the projective line. *Journal of Combinatorial Theory Series A*, 118, no 2, 532–544, 2011.
23. C. Godsil and K. Meagher. Multiplicity-free representations of the symmetric group. *Annals of Combinatorics*, 13(4):463–490, 13(4):463-490, 2009.
24. C. Godsil and K. Meagher. A new proof of the Erdős-Ko-Rado theorem for intersecting families of permutations. *European Journal of Combinatorics*, 30(2):404–414, 2009.
25. K. Meagher, L. Moura and L. Zekaoui. Mixed covering arrays on graphs. *Journal of Combinatorial Designs*, 15(5):393–404, 2007.
26. K. Meagher, L. Moura and B. Stevens. A Sperner-type theorem for set-partition systems. *Electronic Journal of Combinatorics*, 12(1) Note 20, 6 pp. (electronic), 2005.
27. K. Meagher and L. Moura. Erdős-Ko-Rado theorems for uniform set-partition systems. *Electronic Journal of Combinatorics*, 12(1) Research Paper 40, 12 pp. (electronic), 2005.
28. K. Meagher and B. Stevens. Covering arrays on graphs. *Journal of Combinatorial Theory, Series B*, 95(1):134–151, 2005.
29. K. Meagher and B. Stevens. Group construction of covering arrays. *Journal of Combinatorial Designs*, 13(1):70–77, 2005.

Articles Under Review

30. Kokkala J*, Meagher K, Naserasr R, Nurmela K, Ostergard P, Stevens B. (2017). Bounds, structure, and classification of small strength-2 covering arrays. *Electronic Journal of Combinatorics*. Submitted Refereed?: Yes
31. Adm M, Bergen R*, Ihringer F, Jaques S*, Meagher K, Purdy A, Yang B. (2017). Ovoids of generalized quadrangles of order $(q, q^2 - q)$ and Delsarte cocliques in related strongly-regular graphs. *Journal of Combinatorial Designs*
32. Ryan Bergen, Shaun Fallat, Adam Gorr, Ferdinand Ihringer, Karen Meagher, Alison Purdy, Boting Yang and Guanglong Yu. Infection in Hypergraphs. Submitted to *Discrete Applied Mathematics*, Jan 2017.
33. Aras Erzurumluoğlu, Karen Meagher, and David A. Pike. Brushing Number and Zero-Forcing Number of Graphs and their Line Graphs. Submitted to *Discrete Applied Mathematics*, Sept. 2016.
34. Shaun Fallat, Karen Meagher, Abolghasem Soltani and Boting Yang. Compressed Cliques Graphs, Clique Coverings and Positive Zero Forcing. Submitted to *Theoretical Computer Science*, Oct. 2016.

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Other Publications

33. Karen Meagher and Irene Sciriha. Graphs that have a weighted adjacency matrix with spectrum $\{\lambda_1^{n-2}, \lambda_2^2\}$. Available on ArXiv (2015). This paper will not be published since similar results are given in other recent publications.
34. Karen Meagher and Alison Purdy. The exact bound for the Erds-Ko-Rado theorem for t-cycle-intersecting permutations. Available at arXiv. This paper will not be published in a journal since a 2011 paper by V. M. Blinovsky uses a similar method to get essentially the same result.
35. Karen Meagher. Covering arrays on graphs: qualitative independence graphs and extremal set-partition theory. *Ph.D. thesis*, University of Ottawa, 177 pages, Sept. 2005.
36. K. Meagher. "Group Construction of Covering Arrays — Part 2." *Technical Report*, <http://www.site.uottawa.ca/school/publications/techrep/2005>, 5 pages, Jan. 2005.
37. K. Meagher. "Covering arrays on small, edge-critical graphs." *Table of Results*, 400 pages, Sept. 2002.
38. K. Meagher. Convolution estimates with Orlicz spaces. *Masters thesis*, University of Waterloo, 130 pages, May 1997.

Seminars and Conferences

Invited Presentations

- 09/17 Finite Geometries, Fifth Irsee Conference, Kloster Irsee, Germany. Invited Speaker.
- 06/17 The Second Malta Conference in Graph Theory and Combinatorics. University of Malta, Malta. Invited Speaker.
- 04/16, IntersectionFest, Invited speaker, Virginia Commonwealth University, Richmond Virginia.
- 06/15 CanaDAM, Saskatoon, SK. Plenary speaker *Algebraic Approaches to the Erdős-Ko-Rado Theorem*.
- 11/14 University of Malta, Malta Colloquium speaker *The Erdős-Ko-Rado Theorem: an Algebraic Perspective*
- 06/14. Algebraic Combinatorics: Spectral Graph Theory, Erdős-Ko-Rado Theorems and Quantum Information Theory *Erdős-Ko-Rado theorems: an algebraic perspective*
- 06/14 Modern Trends in Algebraic Graph Theory Conference. Villanova University, Conference Speaker *The Erdős-Ko-Rado Theorem: an algebraic perspective*.
- 04/14 Invited speaker at the Arizona State University Combinatorics Seminar.
- 05/13 Ottawa-Carleton Discrete Math days, Ottawa, On. *The EKR theorem for permutations*.
- 05/12 Prairie Discrete Math Workshop, Calgary Alberta. Invited speaker *The EKR theorem for permutations*.
- 11/11 University of Regina Computer Science Colloquium. *My (Mathematical) Problems with Computer Scientists*.
- 05/10 Ontario Combinatorics Workshop, Brock University. Invited speaker, *The Erdős-Ko-Rado Theorem*.
- 04/10 Discrete Math Seminar, Arizona State University. Invited colloquium, *An algebraic approach to Erdős-Ko-Rado Theorems*.

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- 02/07 Ottawa-Carleton Institute for Mathematics and Statistics Joint Colloquium, University of Ottawa. OCIMS PhD Prize Lecture, *Extremal Partition Theory*.

Other Presentations

- 06/16 Canadian Mathematics Society Summer Meeting. Edmonton, AB, Session speaker *Derangement Graphs for 2-transitive Groups*
- 10/15 University of Regina Colloquium (Sabbatical Talk) *Algebraic Approaches to the Erdős-Ko-Rado Theorem*
- 06/15 CanaDAM, Saskatoon, Session speaker *Graphs that have a weighted adjacency matrix with spectrum $\{\lambda_1^{n-2}, \lambda_2^2\}$.*
- 04/15 University of Malta, Malta Colloquium speaker *Introduction to Association Schemes*
- 06/14 Canadian Math Society Summer Meeting. Winnipeg, Manitoba, Conference Speaker *Graph Theory and the Erdős-Ko-Rado Theorem*.
- 06/13 CanaDAM, St. John's NL. Session speaker *Minimum number of distinct eigenvalues of a graph and Covering arrays on graphs*.
- 06/12 Canadian Mathematics Summer Conference, *Sperner partition systems*.
- 07/11 Graphs, Designs and Algebraic Combinatorics, University of Regina, *The Erdős-Ko-Rado Theorem*.
- 06/11 Canadian Mathematics Society Summer Meeting, University of Alberta. Session Speaker, *The Erdős-Ko-Rado Theorem: An Algebraic Perspective*.
- 05/11 Prairie Network for the Mathematical Sciences. Conference Talk, *The Erdős-Ko-Rado Theorem*.
- 04/11 BIRS Workshop on Algebraic Combinatorics. Session Speaker, *The Erdős-Ko-Rado Theorem: An Algebraic Perspective*.
- 03/10, Mathematics Department Colloquium, University of Regina. Colloquium talk, *Erdős-Ko-Rado Theorems for permutations*.
- 05/09 Canadian Discrete and Applied Mathematics Conference (CanaDAM), Université de Montréal. Conference talk, *The Erdős-Ko-Rado for Permutations*.
- 07/08 Association Schemes and Scheme Rings Conference, University of Regina. Conference talk *Erdős-Ko-Rado-Type Theorems and Association Schemes*.
- 05/08 Ottawa-Carleton Discrete Math Day and the Ottawa Graph Theory Conference, Ottawa. Conference talks, *Applications of Graph Theory to Covering Arrays* and *A Multi-Partite Erdős-Ko-Rado Theorem*.
- 10/07 American Mathematics Society, Fall Central Section Meeting, DePaul University, Chicago. Conference talk, *Association Schemes and Set-Partition Systems*.
- 05/07 CanaDAM 2007, BIRS, Banff. Conference talks, *Association Schemes and Set-Partition Systems* and *Covering Arrays on Graphs*.
- 02/07 Tutte Seminar, University of Waterloo. Seminar talk, *Extremal Partition Theory*.
- 07/05 Algebraic Graph Theory Seminar, University of Waterloo. Invited talk, *Covering Arrays on Graphs*.
- 03/04 Séminaire de Combinatoire et d'Informatique Mathématique, LaCIM, UQAM, Montréal. Invited talk, *Covering arrays and related problems in extremal combinatorics*.

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- 07/03 Dimacs Connect Institute '03, Rutgers' University, Piscataway. Conference talk, *A new construction for covering arrays.*

Research Grants

2013 – 2018	NSERC Discovery Grant	\$15,000/year
2008 – 2013	NSERC Discovery Grant	\$15,000/year
2007	Matching Funds VP-Research University of Regina	\$2,500
2007 – 2012	NSERC Discovery Grant	\$13,500/year

Professional Activities

Conference Organization

- Co-organizer for the 2017 Prairie Discrete Math Workshop.
- Member of the Organizing committee for the Emerging Mathematics Teachers Workshop. Winnipeg Manitoba, May 2016.
- Member of the Organizing committee for the conference: *Algebraic Combinatorics: Spectral Graph Theory, Erdős-Ko-Rado Theorems and Quantum Information Theory A Conference to celebrate the work of Chris Godsil* at the University of Waterloo, June 2014.
- Co-organized (with Dr. Robert Bailey and Dr. Shaun Fallat) two conferences for July 2011 (Graphs, Designs and Algebraic Combinatorics and Prairie Discrete Math Workshop).
- Co-organized (with Chris Godsil) a Workshop on Cocliques and Colouring (06/09) We received \$10,600 from the Fields Institute for this workshop.
- Co-organized (with Allen Herman) an international conference held at the University of Regina on the topic of association schemes (07/08). We received \$17, 945 from PIMS and other sources for this conference.
- Organized sessions at the following conferences: CanaDAM 2015 in Saskatoon, CMS summer meeting in Regina 2012, CMS summer meeting in St. John's, 2009, CanaDAM 2007, Banff.

Refereeing for Research Journals

1. 2017: Transactions on Algorithms, European Journal of combinatorics
2. 2016: Theory of Computing Systems, Journal of Combinatorial Theory Series A, Discrete Applied Math, Contributions to Discrete Mathematics, Journal of Algebraic Combinatorics, SIAM Journal on Discrete Mathematics.
3. 2015: European Journal of Combinatorics, Discrete Mathematics, Ars Mathematica Contemporanea, Journal of Algebraic Combinatorics, LAGOS 2015
4. 2014: Linear Algebra and its Applications.
5. Previous years: Acta Mathematica Hungarica; Acta Mathematica Sinica, American Mathematical Monthly, Australasian Journal of Combinatorics, Discrete Mathematics European Journal of Combinatorics, Journal of Combinatorial Designs, Journal of Combinatorial Theory (Series B), Linear Algebra and its Applications, Mathematica Bohemica, Order, SIAM Journal on Discrete Mathematics, Special Matrices.

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Other Professional Activities

1. Main organizer for the University of Regina's Discrete Math Research Group. This a group of professors, post-doctoral researchers and graduate students who meet weekly to work on open problems in discrete math. This group has been active for 6 years and has published several research papers.
2. Member of the Canadian Discrete and Algorithmic Mathematics Conference, (CanaDAM) 2011 program committee.
3. Panel member for CMS student session "How to get scholarships" at the Canadian Mathematics Society summer meeting, Memorial University of Newfoundland – 06/09.
4. Support a successful application of a PIMS post-doctoral fellowship for Dr. Ferdinand Ihringer (2016) and Dr. Robert Bailey (2009).

Teaching

Research Supervision

1. Adam Gorr – Masters Student (current, co-supervised with Dr. Fallat)
2. Ferdinand Ihringer – PIMS Post-Doctoral Fellow. 07/16–07/17
3. Sam Jaques – USRA summer student 04/2016–08/2016
4. Alison Purdy – Post-Doctoral Fellow. 08/14–11/15.
5. Alison Purdy – Ph.D. student. Completed 08/14.
6. Adam Dyck – USRA summer student 04/2013–08/2013, and 04/2014–08/2014.
7. Bahman Ahmadi – Ph.D. student. Completed 07/13.
8. Fatemeh Alinaghypour – Ph.D. student (co-supervised with Dr. Fallat). Completed 07/13
9. Robert Bailey – PIMS post-doctoral Fellow (2009-2012).
10. External Examiners for the following students: **Fatemeh Bayeh** (M.Sc in CS, University of Regina, 2017); **Kseniya Garaschuk** (PhD Math/Stat, University of Victoria, 2014)
11. Committee member for the following graduate students: André dos Santos (M.Sc. CS, 2016), Marzieh Bayeh (Ph.D. 2016), Gurmail Singh (Ph.D. 2015), Ryan Tessier (Masters 2013), Gaojian Fan (Masters 2012), Mike Cavers (Ph.D. 2010), Ryan Tifenbach (Masters 2007).

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Courses Taught

- 2016 Math 112 (this was a new course), Math 103, Math 223, Math 498 and assisted with Math 902
- 2015 Math 327, Math 103
- 2014 Math 122, Math 110
- 2013 Math 127, Math 427/827, Math 327
- 2012 Math 127, Math 223, Math 221
- 2011 Math 890AK (a graduate reading course)
- 2010 Math 122, Math 223, Math 327, Math 427/827, Math 890AG (a graduate reading course in Representation theory of the symmetric group)
Math 890 AK (a graduate reading course in extremal combinatorics)
- 2009 Math 122, Math 221, Math 327, Math 828 (a graduate course in algebraic graph theory)
- 2008 Math 122, Math 221, Math 101
- 2007 Math 327

Curriculum Development

- Assisted in developing a new course Math 112, Applied Mathematics II. I taught the first section of this new course.
- Creating a lab manual for Math 103 and Math 112.
- Created a new component for Math 902 that teaches grant writing to graduate students.
- Wrote the syllabus for Math 497/498 and a grading rubric for these two courses.
- I have been helping develop a document outlining best practises for our instructors. I wrote an extensive section on dealing with academic misconduct.

Participation in University Committees

- Chair of the Mathematics Undergraduate Studies Committee (2013-2016)
- Member of the Faculty Review Committee (2015 - 2016)
- Member of the Physics hiring committee (2016)
- Member of the Faculty of Science Associate Dean (Research & Graduate) Reappointment Advisory Committee. (2016)
- NSERC Advisory Group (2016- present)
- Member of the Faculty of Science Admissions and Studies Committee (2011-2016)
- Member of the Department of Mathematics and Statistics Committee on Undergraduate Studies (2012-2013)
- Chair/Vice-Chair of University of Regina Women in Science and Engineering (URWISE)
 - Organized the Annual URWISE Lecture Series, 2009–2012.
 - Organized the Annual URWISE NSERC grant writing workshop, Sept. 2009–2013.
- Math, Actuarial Science and Statistics Student Society (MASS) Faculty Representative 2011–2013.
 - Organizer and speaker for Pi day 2010–2013
- Faculty of Graduate Studies Ph.D. Committee (09/08 - 09/11)

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- NSERC URSA selection committee (02/10)
- Executive of Council Committee (09/08 - 09/09)

Other Volunteer Activities

- Volunteer leader for Girl Guides of Canada 2011–present
- Volunteer with Cathedral Area Community Association (on going), New Dance Horizons 2015, 2016
- Volunteered with University of Regina Science camp
- Invited speaker at the Saskatchewan High School Science Fair Winners' Showcase banquet, Oct, 2012
- Volunteer with the GSA research conference (chair for the Math/CS session) March 12, 2010
- Volunteer with Math Camp (2008, 2009, 2012, 2013)

Honours, Awards, and Fellowships

1. University of Ottawa Pierre Laberge doctoral prize for an outstanding Ph.D. thesis in the Sciences, \$500, Oct/06.
2. Ottawa-Carleton Institute for Mathematics and Statistics Doctoral Prize, \$500, Dec/06.
3. NSERC Postdoctoral Fellowship, University of Waterloo, \$40,000, Oct/05-05/07.
4. Mathematics Teaching Assistant of the Year, \$250, University of Ottawa, Sept/02.
5. NSERC PGS-B, University of Ottawa, \$19,100, May/02–May/04.
6. National Excellence Scholarship, tuition, University of Ottawa, May/02– Aug/05.
7. Provost Scholarship, \$3,000, Institutional of Waterloo, Sept/95 – Apr/97.
8. Dean's Silver Medal, University of Alberta, 1995.