Scott H. Murray
Curriculum vitae

Department of Mathematics & Statistics
University of Sydney
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Education

Ph.D. October 1995—August 2000.
University of Chicago, Illinois, USA.
Thesis: "Conjugacy classes in maximal parabolic subgroups of the general linear group."
Advisor: Prof. J. L. Alperin.

S.M. (Master of Science). October 1994—June 1995.
University of Chicago, Illinois, USA.

B.Sc.(Hons). January 1990—December 1993.
Australian National University, Canberra, Australia.
Major: Mathematics.
Thesis: "The Schreier-Sims algorithm."
Advisor: Prof. E. A. O'Brien.

Grants, Fellowships and Prizes

Marie Curie Individual Fellowship. November 2002.
European Commission.

Sesquicentennial Postdoctoral Fellowship. August 2002.
University of Sydney, New South Wales, Australia.

Fulbright Postgraduate Student Award. September 1994—October 1999.
Australian-American Fulbright Commission.

University Fellowship. October 1994—October 1995.
University of Chicago, Illinois, USA.

University Medal. December 1993.
Australian National University, Canberra, Australia.

Academic positions

Senior Research Fellow (Academic Level B). August 2007—Now.
University of Sydney, New South Wales, Australia.
Research in computational Lie theory and computational group theory.

Sesquicentennial Postdoctoral Fellowship. August 2002—March 2003, April 2004—September 2004 and October 2005—July 2007.
University of Sydney, New South Wales, Australia.
Postdoctoral research in computational Lie theory and computational group theory.

Marie Curie Individual Fellowship. April 2003—March 2004 and October 2004—September 2005.
Eindhoven University of Technology, Netherlands.
Postdoctoral research in computational methods for groups of Lie type and design of experiments (statistics).

Postdoctoral position. August 2001—July 2002.
Eindhoven University of Technology, Netherlands.
Postdoctoral research in computational methods for finite groups of Lie type and automated deduction.

Visiting Scholarship. August 2000—July 2001.
University of Sydney, New South Wales, Australia.
Postdoctoral research in computational Lie theory and computational group theory. Developed a MAGMA package for computing in groups of Lie type.

Research assistant. April 1999—August 2000.
University of Chicago, Illinois, USA.
Researched methods for generating random elements in groups with Prof. László Babai. Supervised research by two undergraduate students.

Research papers

Scott H. Murray and Man V. M. Nguyen, "Enumeration of strength 3 mixed orthogonal arrays," submitted.

Arjeh M. Cohen, Scott H. Murray, and Sergei Haller, "Computing with root subgroups of twisted reductive groups," submitted.

Scott H. Murray and Colva M. Roney-Dougal, "Constructive homomorphisms for classical groups," submitted.

Arjeh M. Cohen and Scott H. Murray, "Algorithm for Lang's Theorem," *J. Algebra* **322**(3) (2009) 675–702.

Arjeh M. Cohen, Sergei Haller, and Scott H. Murray, "Computing in unipotent and reductive algebraic groups," *LMS J. Comput. Math.* **11** (2008) 343–366.

Arjeh M. Cohen, Jan Willem Knopper, and Scott H. Murray, "Automatic proof of graph nonisomorphism," *Math. Comput. Sci.* **2**(2) (2008) 211–229.

Scott H. Murray, "Representations of parabolic and Borel subgroups," *Comm. Algebra* **35**(2) (2007) 455–459.

Arjeh M. Cohen, Scott H. Murray, and D. E. Taylor, "Computing in groups of Lie type," *Math. Comp.* **73** (2004) 1477-1498.

Arjeh M. Cohen, Scott H. Murray, Martin Pollet, and Volker Sorge, "Certifying solutions to permutation group problems," *Automated Deduction—CADE–19*, F. Baader (ed), *Lecture Notes in Artificial Intelligence* **2741** (2003) 258–273.

Petra E. Holmes, Stephen A. Linton, and Scott H. Murray, "Product replacement in the Monster group," *Experiment. Math.* **12**(1) (2003) 123–126.

C. R. Leedham-Green and Scott H. Murray, "Variants of product replacement," *Computational and Statistical Group Theory (Las Vegas, NV/Hoboken, NJ, 2001)*, *Contemp. Math.* **298** (2002) 97–104.

Scott H. Murray, "Conjugacy classes in maximal parabolic subgroups of the general linear group," *J. Algebra* **233** (2000) 135–155.

Frank Celler, C. R. Leedham-Green, Scott H. Murray, Alice C. Niemeyer, and E. A. O'Brien, "Generating random elements of a finite group," *Comm. Algebra* **23** (1995) 4931–4948.

Scott H. Murray and E. A. O'Brien, "Selecting base points for the Schreier-Sims algorithm for matrix groups," *J. Symbolic Comput.* **19** (1995) 577—584.

Preprints and documentation

Arjeh M. Cohen, Willem de Graaf, Scott H. Murray, and D. E. Taylor, "Coxeter groups" and "Lie groups," chapters in *Handbook of Magma functions*, J. Cannon, W. Bosma (eds), available online at `magma.maths.usyd.edu.au/magma/htmlhelp/MAGMA.htm`.

Arjeh M. Cohen and Scott H. Murray, "An automated proof theory approach to computation with permutation groups," course notes for a course given by Arjeh M. Cohen at the *Calculemus Autumn School 2002*.

Lisa Carbone, Leigh Cobbs, and Scott H. Murray, "Fundamental domains for congruence subgroups of SL_2 in positive characteristic," preprint (2009).

Scott H. Murray and Neil Saunders, "Magma proof of strict inequalities for minimal degrees of finite groups," preprint (2009).

Gene Cooperman and Scott H. Murray, "Computable subgroup chains and shadowing," preprint (2002).

Software

Only publically released software is listed.

Conjugacy in classical groups. MAGMA. 2009.

Highest weight representations of Lie algebras and reductive algebraic groups. With Dan Roozemond. MAGMA. 2006.

Proof assistant for graph isomorphism. Jan Willem Knopper under my supervision. Java, GAP4, and nauty. 2004.

Constructing mixed orthogonal arrays. Man V. M. Nguyen under my supervision. GAP4, nauty, and S. 2003.

Galois cohomology and twisted forms of groups of reductive algebraic groups. With Sergei Haller. MAGMA. 2003.

Split reductive algebraic groups (groups of Lie type). With Sergei Haller. MAGMA. 2002.

Root systems, root data, and finite reflection groups. With Don Taylor; partly based on CHEVIE. MAGMA. 2001.

Subgroup chains and shadowing. GAP4. With Gene Cooperman. 2000.

Improved Schreier-Sims algorithm for matrix groups. C; incorporated into MAGMA with Bill Unger. 1993.

Work in progress

Arjeh M. Cohen, William M. Kantor, and Scott H. Murray, "Constructive Sylow Theorems for exceptional groups of Lie type," work in progress.

Sergei Haller and Scott H. Murray, "Computing conjugacy in finite classical groups," work in progress.

Scott H. Murray, "Recognising finite Lie algebras," work in progress.

Selected presentations

"Graphs of groups in Magma." August 2009. Plenary at the Special Day for John Cannon and Derek Holt, Groups St Andrews. Bath, United Kingdom.

"Computing with the Lie correspondence." July 2009. Invited talk at Matrix Group Recognition meeting of the International Centre for Mathematical Sciences. Edinburgh, United Kingdom.

"Applications of the Lie correspondence to matrix group recognition." January 2009. Group Theory, Combinatorics and Computation (in honour of Cheryl Praeger), Perth, Australia.

"Algorithmic recognition of Lie algebras." September 2007. 51th Annual Meeting of the Australian Mathematical Society, Melbourne, Australia.

"Computing in linear algebraic groups." September 2006. 50th Annual Meeting of the Australian Mathematical Society, Sydney, Australia.

"Computing in soluble linear algebraic groups." July 2005. Groups St Andrews, St Andrews, United Kingdom.

"Conjugacy and twisted conjugacy in classical groups." February 2005. Invited talk st the International meeting on Geometry - Interactions with Algebra and Analysis, Auckland, New Zealand

"Algorithm for Lang's Theorem." September 2004. Victorian Algebra Conference, Melbourne, Australia.

"Computing in groups of Lie type." April 2004 Dutch-Belgian Mathematical Conference, Tilburg, Netherlands.

"Computation in groups of Lie type". July 2001. Invited talk at the Oberwolfach meeting on Computational group theory. Oberwolfach, Germany.

"Representations of Borel subgroups and parabolic subgroups". May 2000. Conference on Representation Theory and Computational Algebra, University of Georgia, USA.

"Conjugacy classes in parabolic subgroups." December 1999. Conference on Group Theory and Computation, Sydney, Australia.

"Conjugacy classes in parabolic subgroups of general linear groups." October 1999. Invited talk at the American Mathematical Society Eastern sectional meeting, Providence, Rhode Island, USA.

"Quality of random elements in groups." June 1999. Invited talk at the DIMACS conference on Groups and Computation, Colorado, Ohio, USA.

Teaching experience

Lecturer. July 2008—December 2008.
School of Mathematics and Statistics, University of Sydney, Australia.
Designed, taught and assessed the course Pure Mathematics Honours 6: Group Theory. This covered structure theory of classical groups and introduced groups of Lie type.

Lecturer. September 1996—April 1999.
College of the University of Chicago, Illinois, USA.
Lectured, developed syllabi, set exams, designed webpages, and assigned grades for:

- Mathematics 151–3: Calculus (for students who had calculus in high school).
- Mathematics 131–3: Calculus and elementary functions (for students with no previous calculus experience). This course also involved supervising tutors.
- Mathematics 195–6: Mathematical methods for the Social sciences (linear algebra and multivariate calculus for economics majors).

Consistently rated very highly in student evaluations.

Volunteer mathematics teacher. January 1999—May 1999.
Blue Gargoyle adult literacy program, Chicago, Illinois, USA.
Taught arithmetic and elementary algebra to adults studying for the GED (high school equivalency exam).

Volunteer mathematics teacher. Spring 1998.
Explore and discover program, Fiske Elementary School, Chicago, Illinois, USA.
Planned and taught a "Math fun" program on symmetry and geometry for first and second grade students.

College fellow. September 1995—May 1996.
College of the University of Chicago, Illinois, USA.
Ran problem sessions, set exams and graded for Mathematics 161–3 (Honors calculus).

Tutor. February 1993—December 1993.
Australian National University and University of Canberra, Canberra, Australia.
Ran problem sessions and graded for courses on linear algebra, multivariate calculus, and differential equations.

Tutor. January 1993.
Australian Mathematics Summer School, Canberra, Australia.
Taught abstract algebra and Euclidean geometry to high school students.

Advising students in research

Students I have (co)supervised, together with titles of their theses or projects:

- Leigh Cobbs, Ph.D., Rutgers University, ongoing.
- Sergei Haller, *Computing Galois cohomology and forms of linear algebraic groups*, Ph.D. thesis, Technical University of Eindhoven, 2005.

- Nguyen Van Minh Man, *Computer-algebraic methods for the construction of designs of experiments*, Ph.D. thesis, Technical University of Eindhoven, 2005.
- Jan Willem Knopper, *Automatic Proofs of Graph Nonisomorphism*, Masters thesis, Technical University of Eindhoven, 2005.
- Chris Krook, *Groups related to $E_7(q)$: A quest for distance-transitivity*, Masters thesis, Technical University of Eindhoven, 2003.
- Vincent Remie, *Graph isomorphism problem*, Undergraduate thesis, Technical University of Eindhoven, 2003.
- Ben Chad, *Constructing finite subgroups of simple Lie groups*, Summer scholarship (Research experience for undergraduates), University of Sydney, 2003.
- Rebecca Virnig and Walter Kim, *Random elements in finite groups*, Undergraduate research project, Department of Computer Science, University of Chicago, 2001.

Service

Chair of the graduate student advisory committee. September 1998—January 2000.
Department of Mathematics, University of Chicago, Illinois, USA.
Chaired a committee of graduate students set up to improve communication between students and the faculty.

Chair of the graduate student Algebra III committee. April 2000.
Department of Mathematics, University of Chicago, Illinois, USA.
This was an *ad hoc* committee formed to make suggestions on the new syllabus of a graduate level algebra course.

Student representative for third year honours students. January 1992—December 1992.
Department of Mathematics, Australian National University, Canberra, Australia.
Represented students in dealings with members of faculty.

Reviewer for American Mathematical Society MathReviews.

Professional society memberships

Australian Mathematical Society.

American Mathematical Society.

Mathematical Association of America.

Skills

Languages: Advanced Dutch, Intermediate French, Beginning German.

Computer languages and systems: MAGMA, GAP4, GAP, Traditional C, Pascal, Linux.

References

Prof. Cheryl Praeger, AM. Fellow of the Australian Academy.
University of Western Australia, 35 Stirling Hwy, Crawley, WA 6009, Australia.
praeger@maths.uwa.edu.au, +61 8 3344-9380, +61 8 9380-1028 (fax).

Prof. Lisa Carbone.
Rutgers University, 110 Frelinghuysen Rd, Piscataway, NJ 08854-8019, USA.
carbonel@math.rutgers.edu, +1 732 445-1310, +1 732 445-5530 (fax).

Prof. Arjeh M. Cohen.
Technische Universiteit Eindhoven, Postbus 513, 5600 MB Eindhoven, Netherlands.
amc@win.tue.nl, +31 40 247-4270, +31 40 243-5810 (fax).

Dr. Diane Herrmann (teaching referee).
University of Chicago, 5734 S. University Avenue, Chicago, Illinois 60637, U.S.A.
diane@math.uchicago.edu, +1 773 702-7332, +1 (773)702-9787 (fax).