

CURRICULUM VITAE

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MAHRUD SAYRAFI

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EDUCATION

- University of Minnesota, Twin Cities**, Ph.D. Candidate in Mathematics Since Fall 2018
Expected Graduation: May 2023 ADVISOR: Christine Berkesch.
- University of California, Berkeley**, B.A. with Honors in Mathematics 2014 – 2017
THESIS: Local Computations in Macaulay2 ADVISOR: David Eisenbud.
- Math in Moscow** Spring 2016
Semester abroad at the Independent University of Moscow and Higher School of Economics.

GRANTS AND FELLOWSHIPS

- Honorable Mention, Graduate Research Fellowships Program, NSF** Spring 2020
- John Ordway Fellowship, School of Mathematics, University of Minnesota** 2018 – 2020
- Seed Grant, DRP Network** Fall 2018
Awarded to the Directed Reading Program at UMN.
- Leadership Award, Cal Alumni Association, UC Berkeley** Fall 2016
Awarded for efforts to improve inclusivity and diversity within the undergraduate mathematics community as a member of the Mathematics Undergraduate Student Association at UC Berkeley.
- Math in Moscow Scholarship, American Mathematical Society** Spring 2016
Recipient of scholarship, funded by NSF and administered by AMS, to study abroad in Moscow.

PUBLICATIONS AND PRESENTATIONS

- “The virtual resolutions package for Macaulay2” [arXiv:1905.07022](https://arxiv.org/abs/1905.07022) [math.AG]
A. Almousa, J. Bruce, and M. C. Loper. *J. of Software for Algebra & Geometry* **10** (2020), 51–60.
- “Symbolic Computation of Invariants of Local Rings” Aug. 2019
Intersections in Practice Mini-symposium at the SIAM Applied Algebraic Geometry Conference.
- “Local Computations in Macaulay2,” honor’s thesis. [arXiv:1710.09830](https://arxiv.org/abs/1710.09830) [math.AC]
Presentation at the Joint Mathematics Meetings. Jan. 2018
Poster presentation at the SIAM Applied Algebraic Geometry Conference. Aug. 2017
- “What is the optimal way to prepare a Bell state using measurement and feedback?” Apr. 2017
L. Martin and K. B. Whaley. *Quantum Sci. & Technol.* **2** 044006.
- “Towards Device-Independent Tripartite Quantum Key Distribution” Feb. 2015
Poster presentation at the 17th Annual SQuInT. (goo.gl/329zYR)
- “Reconstructing Secret Shares using Secure Multiparty Computation” Aug. 2013
Presentation at the Jet Propulsion Laboratory. (goo.gl/UaWQRY)

CONFERENCES and SUMMER SCHOOLS

- Combinatorial Algebraic Geometry, ICERM** Spring 2021
Topics: Flag and Schubert varieties, toric varieties, tropical varieties, cluster algebras and varieties
- Length 3 Resolutions Workshop, UC San Diego** Aug. 2019
Topics: Representation theory of grade 3 perfect ideals
- Thematic Program in Commutative Algebra, University of Notre Dame** Jun. 2019
Topics: Linkage theory and residual intersections, Rees algebras, multiplicity theory
Macaulay2 Teaching Assistant at the MSRI Summer School
- D-Modules and Hodge Theory Workshop, University of Illinois at Chicago** Nov. 2018
Topics: D-modules, Hodge modules and ideals, V-filtrations, and minimal exponents.
- Core Computational Methods in Nonlinear Algebra Workshop, ICERM** Sept. 2018
Topics: numerical algebraic geometry, symbolic computation, and combinatorial methods.
- Geometry of Redistricting Workshop, University of San Francisco** Mar. 2018
Topics: Gerrymandering, voting rights, discrete geometry and graph theory

VOLUNTEERING AND SERVICE EXPERIENCE

- Directed Reading Program, University of Minnesota, Twin Cities**, Organizer Since 2018
Matching undergraduate and graduate students in guided mathematics reading projects.
- AMS Graduate Student Blog**, Staff Writer Since 2019
Writing about mental health in graduate school and the directed reading program.
- Graduate Student Combinatorics Conference**, Session Chair Apr. 2021
Chair of session on Combinatorial Algebraic Geometry
- Girls Who Code @ Cloudflare**, Cryptography Workshop Leader Jul. 2018
Instilling an appreciation for mathematics in high school girls using elliptic cryptography puzzles.
- Department of Mathematics, Cornell University**, C++ Developer Fall 2017
Developing internal engine support for local ring computations in Macaulay2.
- Pauline Sperry Undergraduate Lecture Series, UC Berkeley**, Organizer 2017 – 2018
Coordinating an annual lecture series aimed at providing a role model for minority students in math.
- Mathematics Undergraduate Student Association**, President 2016 – 2017
Improving inclusivity and diversity of the undergraduate math community at Berkeley.
- Department of Mathematics, UC Berkeley**, Peer Advisor Fall 2015
Assisting students with requirements, resources, opportunities, untying bureaucratic knots, etc.
- Berkeley mini Math Tournament**, Grader and Lecturer Nov. 2014 & 2015
Instilling an appreciation for knot theory in advanced elementary or middle school students.
- Caltech InnoWorks**, Mentor Aug. 2014
Introducing middle schoolers with disadvantaged backgrounds to STEM.

TEACHING EXPERIENCE

- School of Mathematics, University of Minnesota, Twin Cities**
MATH 2243: TA for four sections of Linear Algebra & Differential Equations. Spring & Fall 2019
MATH 1271: TA for two sections of Calculus 1. Fall 2018
- Department of Mathematics, UC Berkeley**
Math113: graded homework for Abstract Algebra. Spring 2015
Math116: graded homework and assisted the instructor for Mathematical Cryptography. Fall 2014
- Math Center, Irvine Valley College** 2013 – 2014
Tutored lower-div courses including linear algebra, differential equations, and discrete math.
- Mathobotix** 2012 – 2014
Developed curriculum for computer science-based problem-solving using Python on Raspberry Pi.

WORK EXPERIENCE

- Mathematical Sciences Research Institute**, Macaulay2 Developer 2020
Worked on modernizing internal components of the software for computations in algebra and geometry.
- Cloudflare, Inc.** Cryptography Engineering Intern Summer 2018
Launched multiple products involving Tor, distributed randomness generation, and Keyless.
- Proton Research, Inc.** Cryptography Research and Development Intern Winter 2018
Added support for elliptic curve cryptography in OpenPGP.js.
- Department of Astronomy, UC Berkeley**, Sysadmin Assistant Fall 2015
Worked on deploying two-factor authentication and a departmental computing grid using LTSP.

RESEARCH EXPERIENCE

- Institute for Quantum Computing, University of Waterloo** Summer 2017
Research fellowship on quantum error correcting codes from algebraic curves with John Watrous.
- Berkeley Quantum Information and Computation Center, UC Berkeley** 2015 – 2016
Research on control theory and entanglement generation with Leigh Martin and Birgitta Whaley.
- California Institute of Technology** Summer 2014
Research fellowship on quantum game theory and semi-definite optimization with Thomas Vidick.
- Jet Propulsion Laboratory** Summer 2013
Research fellowship in secure multiparty computation and secret sharing with Ed Chow.

OPEN SOURCE PROJECTS

Selected Macaulay2 Packages

Since 2017 I have contributed to various components of Macaulay2, including the engine, interpreter, core mathematical routines, and documentation. I have also co-authored the following packages:

- Saturation** with Justin Chen and Mike Stillman 2020
A package for computing saturations and quotients of ideals and modules.
- FGLM** with Dylan Peifer 2019
A package for computing Gröbner bases of zero-dimensional ideals.
- VirtualResolutions** with A. Almousa, J. Bruce, and M. C. Loper Since 2018
A package for computing virtual resolutions of multigraded ideals and modules.
- LocalRings** with Mike Stillman Since 2017
A package for symbolic commutative algebra computations on local rings.

Other Projects

- Proof** Since 2019
A Jekyll theme for mathematical writings with support for \LaTeX and the AMS theorem styles.
- eCheque** HackTECH 2014
A two-factor signature scheme for mobile based check deposit apps, awarded by Mitek Systems.
- GesturePi** with Ted Alexander LAHacks 2014
A hand held gaming platform for the visually impaired.
- Photocrypt** with Patricia Hanus HackMIT 2013
A client-side convergent encryption layer for DropBox.

PROFESSIONAL SKILLS

Programming:

Experience in Macaulay2, SageMath, Mathematica, MATLAB, and IDL.
Proficient in Go, Rust, C++, Python, and Node.js. Familiarity with Julia, and Haskell.

PERSONAL

Memberships:

- Student member of the American Mathematical Society. Since 2017
- Student member of SIAM's Activity Group on Algebraic Geometry. Since 2017
- President of UC Berkeley's Mathematics Undergraduate Student Association. 2016 – 2017

Hobbies:

Bringing math and science to the masses through humor. (youtu.be/MiPmpx5iYpA, youtu.be/jn89KFGahtE)

Version 3.141592653589793238, made in October, 2020 using \LaTeX . (Latest revision at goo.gl/97dSND)

References are available upon request.