

ALPHA

Newsletter of the Department of Mathematics Fall 2022

People in the Department

The department is moving into an exciting, new period. The work of the department will be accomplished by the joint efforts of 24 permanent faculty, 2 staff members, and 26 teaching assistants. This fall, we also have the participation of four part-time instructors.

There have been some recent personnel changes. After eight years at the helm, our former chair Dr. Steve Ziebarth has retired. Dr. Melinda Koelling stepped into his shoes and has been leading the department since July 1. Two of our colleagues, Terrell Hodge and Jane-Jane Lo are both on a half-year appointment until they retire.

The department faculty and staff provided instruction and support for the 4,659 students enrolled in Mathematics courses during the academic year 2021-22. At the undergraduate level the department had approximately 100 students in the 3 available math majors and more than 100 math minors. Another 28 students were enrolled in department graduate programs.

Message from the Chairs

Farewell from Steve: I have been asked to make some farewell comments for our revived newsletter that John has been putting together. I am not in favor of long goodbyes, so I will keep my comments brief. We have come through a lot together since I became chair roughly eight years ago. I think every year (except one with no change) involved some kind of giant budget cut, so that loomed over our heads for most decisions, and will likely not recede any time soon. Within our declining budget, we managed to survive COVID, numerous additional retirements, dwindling TA budgets, and potential reductions and streamlining of our graduate programs. Yet, here we are, still alive and kicking and trying to develop plans that will help us face an uncertain future. We don't know how the new budget model (Strategic Resource Management, or SRM) will affect our department as we move forward, but I have every confidence in the faculty who have stepped up to lead the department and the Executive Committee (EC), and are already having an impact on thinking about the department's future, and especially our graduate programs. I hope that everyone will give Melinda their support as she leads the department into more challenging times. I know she is up to this challenge. It has been a supreme honor to have served the department. Farewell; I am off to the Grey Havens!

Hello from Melinda: Greetings from the Department of Mathematics. We are happy to send you news from Western Michigan University.

After years of research, planning and development, WMU began offering a new elementary education program to meet the call for change required by the Michigan's new Teacher Certification Structure, and related new Standards for the Preparation of Elementary Teachers (PreK-3 and 3-6). In the Department of Mathematics, this involves the development of four new courses focusing on mathematical knowledge for teaching along with practical field experiences in schools. We welcomed the first cohort of about 90 students in the Fall of 2021; the second cohort of about 120 students will start this Fall. Thanks to Kate Kline and Terry Grant for their work on this project.

The Department of Mathematics is revising our graduate programs. Last year, John Petrovic led a working group to start the revisions of the mathematics graduate programs, and our department and curriculum committee will continue to develop the new programs for mathematics and mathematics education in the coming year. I hope to report about the changes next year.

We continue to be proud of our students. In the past year, we have had three PhD students graduate. Yuya Kono (Vertex Identification in Graphs) and Peter Broe (Irregular Orbital Domination in Graphs) completed their PhD theses under the direction of Ping Zhang. Joshua Ruk (Maintenance of Cognitive Demand During

Repeated Task Enactments Using a Teaching Practice That Builds on Student Thinking) completed his PhD thesis under the direction of Laura van Zoest. We have also had seven masters' students in our three masters' programs and twenty-two undergraduate students graduate from our current undergraduate programs.

This summer, we said goodbye to our former chair Steve Ziebarth and our former administrative assistant Sue Simons. We are grateful for their leadership and support. I started as Steve's replacement at the start of July, and Lori Diehl started as Sue's replacement in mid-August.

For Fall 2022, we are looking forward to seeing new faces. We are welcoming nine new graduate students in the department. WMU has registered almost 3000 new first year students, many of whom we will see in our classes. We are continuing to adapt to the new world that has emerged after the start of the COVID pandemic. We will offer most of our classes for 2022-2023 in a face-to-face format, with some offered in online or hybrid formats.

We appreciate the generous financial support we have been given in the past. We are grateful for the opportunities this has continued to create for our students and our department, such as scholarships, student travel support, and Pi Mu Epsilon membership. If you can donate, we thank you for doing so. Donations can be made online at wmualumni.org/giving or by following the QR code below:



Checks should be made payable to WMU Foundation with a notation of *For the Department of Mathematics* on the memo line. Please mail your contributions to:

WMU Foundation
Western Michigan University
1903 W Michigan Ave
Kalamazoo, MI 49008-5248

If you wish, you may enclose a note on how you would like your gift to be used. If you have questions, please contact Jessica Hermann-Wilmarth by phone, (269) 387-8873, or by email, Jessica.a.hermann-wilmarth@wmich.edu. Thank you for your generous support.

We appreciate your news. If you are interested in sharing your experiences with our students, please let us know. We are always happy to hear about new possibilities for learning and employment for our students.

Please keep in touch.

Melinda E. Koelling, Chair
Department of Mathematics,
Western Michigan University
Kalamazoo MI 49008-5248
Phone: 269-387-4551
Email: melinda.koelling@wmich.edu

Grant Activity

On quantitative aspects of Ramsey theory, funded by Simons Foundation (\$42,000; September 1, 2017 - August 31, 2022). The main goal of the project is to study problems in Ramsey theory, currently one of the most active areas in combinatorics. Ramsey theory can loosely be described as the study of structure which is preserved under finite decomposition. The classical Ramsey theorem states that for a given integer t there is an integer $n = n(t)$ such that any 2-coloring of the edges of the complete graph on n vertices yields a monochromatic copy of a complete graph on t vertices. The smallest such integer n is called the Ramsey number. Determining the order of magnitude of the Ramsey numbers, as well as that of some generalized Ramsey numbers is one of the major (and still wide open) problems in combinatorics. The project aims to demonstrate how some geometric ideas in conjunction with probabilistic methods can be used in solving such problems. This approach provides a new method for determining asymptotic behaviors of certain Ramsey-type numbers, many of which have withstood decades of active attempts. The award provides support for travel and visitors. Andrzej Dudek is the principal investigator.

Tracking the Longitudinal Development of STEM Majors' Autonomy and Agency in Mathematical Proof and Proving, funded by National Science Foundation (\$299,000, September 2019 - March 2023). Dr. Mariana Levin (WMU), together with Dr. Shiv Karunakaran and Dr. Jack Smith of Michigan State University have a National Science Foundation IUSE (Improving Undergraduate STEM Education) grant to explore the longitudinal experiences of cohorts of STEM students across their proof-intensive upper-division coursework. A core question of interest for the project concerns the way upper-division STEM students respond when they face challenges in their mathematical work. In particular, the project has focused on the interrelations between students' mathematical agency (their felt capacity to take action in response to challenges) and their mathematical autonomy (qualities of action that reflect active resistance to a priori endorsing or replicating the reasoning of mathematical authorities). The team has presented their work at the RUME (Research in Undergraduate Mathematics Education) Conference.

Probabilistic Combinatorics and Constrained Random Processes, funded by Simons Foundation (\$42,000; September 1, 2021 - August 31, 2026). A (p, q) -coloring on n vertices is a coloring of all possible edges with the property that every set of p vertices has at least q different colors among its edges. Erdos and Shelah first defined and studied $f(n, p, q)$, the smallest number of colors needed for a (p, q) -coloring on n vertices. The project is focused on the asymptotics of $f(n, p, q)$ based on the analysis of randomized coloring algorithms using the differential equation method developed and popularized by Wormald. Patrick Bennett is the principal investigator.

The Building on MOSTs (Mathematical Opportunities in Student Thinking), funded by National Science Foundation (\$4,953,821 total; \$1,990,705 for WMU). The project is a collaboration among researchers at Western Michigan University, Michigan Technological University, and Brigham Young University that focuses on improving the teaching of secondary school mathematics by exploring the teaching practices that allow teachers to elicit and take advantage of MOSTs. This work has received funding from NSF for the past ten years. Faculty member Dr. Laura Van Zoest is the Principal Investigator for WMU and WMU alum Dr. Shari Stockero (PhD, 2006) is the Principal Investigator for MTU. The project has over 75 publications and presentations and has provided research opportunities for numerous graduate students, post-docs, visiting scholars, and secondary school mathematics teachers.

Using Student Feedback to Improve the Value of Desmos Activities for Students, funded by Faculty Scholars Award (SFSA) through WMU Office of Research and Innovation. Drs. Melinda Koelling and Tabitha Mingus were awarded the grant (\$1990). The goal of the project was to work with calculus students who had used activities in Desmos and develop a rubric that can be used to evaluate and improve the content and accessibility of the activities.

Faculty Sabbatical News

Our faculty are very active in research and the most fruitful time is during the sabbatical leaves. During the past year, Patrick Bennett was on a leave and in 2022-23 Jim Zhu and Gene Freudenburg are on leave.

During his sabbatical, Patrick Bennett spent focused time collaborating with coauthors. He was able to visit Alan Frieze and Tom Bohman at Carnegie Mellon University and Sean English at University of Illinois Urbana-Champaign. In view of travel restrictions imposed by COVID-19, the research with Pawel Pralat and Ryan Cushman at Ryerson University in Toronto had to be conducted over Zoom. In one of the papers he solved (with coauthors) an old problem of Erdos and Gyrfas.

In the fall semester of 2022, Jim Zhu plans to visit Prof. Stani Maier-Paape at Aachen University, Germany, Prof. Paul Embrechts at ETH Zurich, Switzerland and Professor Jane Ye at University of Victoria, Canada. During his one month visit to Aachen University, Jim will give a short lecture series on Convex Duality and work on a book “Scalar and Vector Risk in the General Framework of Portfolio Theory-A Convex Analysis Approach” in collaboration with S. Maier Paape, P. Judice, and A. Platen. The short one-week visit to ETH will be devoted to extreme value theory and its possible applications on bank balance sheet problems. The visit to University of Victoria will focus on the computational issue arising in the bank balance sheet problems. In the Spring semester of 2023, Jim will visit Prof. Dai Min in Department of Applied Mathematics at Hong Kong Polytechnical University. During the visit, he will teach the graduate course “High frequency and algorithmic trading” and conduct research in financial mathematics.

During sabbatical leave in 2022-23, Gene Freudenburg will travel to work on this project with colleagues J. Draisma and F. Kutzschebauch at the University of Bern (Switzerland), A. Dubouloz and L. Moser-Jauslin at the University of Burgundy (France), and D. Daigle the University of Ottawa (Canada). Gene works in the area of affine algebraic geometry. His current project is investigating ways in which the group $SL(2, \mathbb{C})$ can act on n -dimensional space \mathbb{C}^n over the field \mathbb{C} of complex numbers. The classical case is when $SL(2, \mathbb{C})$ acts as a group of matrices on the vector space \mathbb{C}^n but exotic actions (that is, non-linear actions) were discovered in 1989. His first series of results from this project will appear in the journal *Transformation Groups* later this year.

Student Awards

We are grateful for the wonderful students we have. We are lucky to have endowments in our department which allow us to acknowledge some of our students with financial support; those students are also acknowledged below. In addition, you will find awardees for a Thurgood Marshall Fellowship, the Department Presidential Scholar, the Mathematics Prize Competition, the Graduate Teaching Effectiveness Award, the Department Graduate Service Award, and the Department Graduate Research Award.

Undergraduate:

Colonel Charles E. Bayliss Scholarship. This scholarship is presented to a mathematics major in recognition of an outstanding high school record (preference given to Michigan high school graduates) and the potential for an excellent university career in mathematics. Colonel Bayliss graduated from WMU in 1950. Recipients: Omnahqiran Nair Dazz, Emma Norwood, Martins Arums, Akshat Gulgulia, Seezan Poude, Ritabrato Chatterjee, David Brooks.

Erik A. Schreiner Endowed Memorial Scholarship in Mathematics. This award is presented to two juniors or seniors in the department who have shown outstanding achievement and potential for future contributions in mathematics. Professor Schreiner was a faculty member of the Department of Mathematics from 1963 to 1991. Recipients: Susmita Dey, Aadarsha Thapa, Rabin Chhetri.

Robert Meagher Memorial Scholarship. Presented to a junior or senior mathematics major in recognition of high academic achievement. This award was established in 1993 by the Kalamazoo University High School Class of 1965 in honor of their classmate, Robert Meagher. Recipient: Daria Soboleva.

Grover C. Bartoo Mathematics Award. Presented annually to a mathematics major in recognition of outstanding achievement in the study of mathematics. Professor Bartoo was a member of the Department of Mathematics from 1911 to 1946. Recipient: Emma Norwood.

A. Bruce and Florence M. Clarke Mathematics Scholarship. Presented to outstanding mathematics majors in recognition of excellence in their field of study and their potential for future accomplishments. A. Bruce Clarke was a former chair of the Department of Mathematics as well as a former Provost and Vice President for Academic Affairs at Western Michigan University. He retired from the university in 1991. Recipient: Daria Soboleva.

Herbert Hannon Endowed Scholarship. Presented annually to one full-time or part-time undergraduate student in mathematics education for high academic achievement, with preference given to those in elementary education. Hannon joined the WMU faculty in 1947. Although he taught many different undergraduate courses, Hannon's primary focus was elementary mathematics education. He retired in 1976. Recipient: Amanda Krebs.

Donald and Glenna Southwell Scholarship. This scholarship is presented to a student who has done exemplary work in actuarial science. Funds for this scholarship were graciously donated by Donald and Glenna Southwell. Mr. Southwell graduated with honors from WMU in 1973 with his B.A. in mathematics. He is president and CEO of Unitrin Services Group, a life and health insurance company. Recipient: Omnahqiran Nair Dazz.

Department Presidential Scholar. Each year at a special convocation the President of the University bestows this honor on seniors chosen from each department in recognition of both general academic excellence and excellence within their major department combined with outstanding intellectual promise. Recipient: Daria Soboleva.

WMU Mathematics Prize Competition. This contest evolved from the Freshman/Sophomore Prize Competition Award that the Department held for many years. It is open to all undergraduates of all majors. Its goal is to measure raw talent rather than breadth of knowledge, and the questions require creative problem solving. Winners: Hardik Oswal (1st place and \$500), Daria Soboleva (2nd place and \$300), Kumar Sanu (3rd place and \$200), Andrew Teachout (4th place and \$100), Sagar Khadka Sagar Khadka and Yogesh Mahat (5th place and \$50 each).

Graduate:

Robert C. Seber Memorial Award. Awarded annually to advanced students in the Masters of Arts in Mathematics Education Program for outstanding scholarship. Professor Seber joined the Department in 1956 and served as Professor of Mathematics Education for 22 years. Recipient: Nitchada Kamlue.

Charles H. Butler Excellence in Teaching Award. Presented annually to graduate teaching assistants in recognition of excellence in teaching over an extended period. Professor Butler, a former Chair of the Department, was a faculty member from 1937 to 1965. Recipients: Val Gipper, Steven Janke, Lindsey Dailey, Lauren Weiss, Nick Witt.

Yousef Alavi Doctoral Student Award. Presented to an outstanding doctoral student in mathematics or statistics in recognition of excellence in the student's field of study, covering graduate studies, doctoral examinations, and research activities including the doctoral dissertation. Professor Alavi, a faculty member from 1958 - 1997, chaired the Department from 1989 - 1992. Devoted to all aspects of the graduate program, he served for many years as the Chair of the Graduate Committee and as the Graduate Programs Coordinator, helping develop various Masters and Doctoral Programs. Recipient: Gina Garza-Kling.

Department Graduate Student Teaching Effectiveness Award. Presented to a graduate student in recognition of significant contributions to the teaching mission of the University. Recipient: Caryn Mays.

Department Graduate Service Award. Presented annually to a graduate student in recognition of extraordinary dedication and outstanding service to the Department of Mathematics Recipients: Emily Johnson, Peter Broe.

Department Graduate Research Award. Presented annually to a doctoral student in recognition of scholarly productivity. Recipient: Yuya Kono.

WMU Thurgood Marshall Fellowship. This fellowship is awarded to graduate students who embody the values of Supreme Court Justice Marshall, including justice and equity. Recipient: Yaronn James Arciaga (incoming student)

Pi Mu Epsilon/Math Club

Pi Mu Epsilon welcomed 14 new members. The student officers were Emily Johnson, Lindsey Dailey, and Steven Janke. Steve Ziebarth carried the role of the faculty advisor. The majority of the meetings included interesting talks:

- Andrew Bowling: *Dice, Counting, and the Fifth Dimension*
- Andrzej Dudek: *Math Competition Tips and Tricks*
- Steven Janke: *Random Generation of Numbers... sort of*
- Yara Mahmoud: *Conversation about Internships*
- Linda Lesniak: *Hamiltonian Graphs: A generalization of Nash-Williams' theorem, WIGA and WinCom*
- Makenzie Kuhns: *Pathway to Teaching without an Education Degree*
- Emily Johnson: *A Priceless Conversation Worth at least a \$1,000,000.*

The math club also hosted WMU Mathematics Prize Competition as well as the traditional *Conversations with the Chair*, where students discuss various issues with the department chair, and *Townhall with the Chair Candidates of the Math Department* (A. Dudek, M. Koelling, and T. Mingus). *Western H.E.R.O.E.S: Bystander Intervention Training* was presented in February.

On February 12, 2022, a group of about 15 students gathered for a *Zometool Barnraising*. Led by Dr. David Richter, a Zometool model of the medially truncated 600-cell was assembled. This object is a highly symmetric assembly of 120 regular icosahedra and 600 regular octahedra in 4-dimensional Euclidean space. The geometric construction system Zometool allowed the group to make a remarkably faithful model of one of its 3-dimensional shadows in under 3 hours. As of this writing (November 2022), this model still stands in a tutor lab on the third floor of Rood Hall.

Colloquium and Seminar Talks

Traditionally, colloquium talks are organized to enable interaction between a visitor and the faculty and students. Since this was precluded for safety reasons, there were no colloquium talks. However, department seminars remained very active due to the ability to connect with a speaker far away from Kalamazoo.

Analysis

WMU Analysis Seminar (sometimes called Analysis and Applied Mathematics Seminar) was started more than twenty years ago. Its original objective was to provide a meeting place for faculty to present and discuss their recent research results, or to provide a survey of results from fields which can be interesting for seminar's participants. Students were invited to take part in the seminar and to study research papers, to understand them and to make a presentation based on such study. This activity is an essential ingredient of any research work in mathematics.

For the past three years, the seminar has been using online platform for meetings which gives an opportunity to invite outstanding mathematicians from all around the world. An archive (starting from Spring 2006) can be found at the seminar website at <https://homepages.wmich.edu/%7Eledyaev/analysis.html>. This website also contains links to video recordings and slides of online talks.

Mathematics Education

The Spring 2022 Math Ed Seminar, facilitated by Dr. Mari Levin and Dr. Laura Van Zoest, centered on improving academic writing. The participants read the book, "They Say, I Say: The Moves that Matter in

Academic Writing,” and engaged in using the ideas to discuss and provide feedback on papers, proposals, and presentations that graduate students were working on.

Algebra

The Algebra Seminar was organized by Dr. Clifton Ealy. It was based on the text *Cellular Automata and Groups* by Tullio Ceccherini-Silberstein and Michael Coornaert. In addition to graduate students, the topic of finite state automata attracted a number of undergraduates. The seminar will continue during the 2022-23 academic year offering research opportunities as early as the summer of 2023.

TA seminar

Nineteen new and continuing TAs participated in the seminar facilitated by Drs. Melinda Koelling and Tabitha Mingus. During the 2021-22 academic year, the TA Teaching Seminar was conducted in a hybrid format. The TAs chose to cover topics ranging from using questions to build student understanding to time management in the classroom to building equitable classroom environments that promote inclusion. At the end of the spring semester, the participating TAs wrote their teaching philosophy statements. For 2022-23, Drs. Tabitha Mingus and Jeff Strom are facilitating the seminar.

Comments from the Editor

Any and all comments or suggestions concerning the newsletter are also welcome. More information on the department, the people here, and our programs can be found on the department website: wmich.edu/math/. This newsletter and future issues will be published on this website. We hope to continue regular publication of Alpha on a yearly basis.