Outreach

• **Auburn Math Club.** Hoping to bring a similar experience as what I had at my undergraduate institution, the University of Kentucky, I served as the president of the Mathematics Club at Auburn University for three years where I reformed and reorganized the club (through rewriting the club constitution and reactivating the club from its dormant status). In my tenure, I organized 17 meetings—with an average attendance of 15 members—in which a faculty member or graduate student gave a seminar-style talk; or a panel answered questions about REUs, graduate school, or industry jobs; or a social where students could meet their instructors for the following semester. These kinds of opportunities can be very influential in determining if a student decides to pursue a graduate education.

• **Outreach in secondary education.** At Auburn, I participated in Destination STEM where around 1,200 middle school students from 16 schools in the southeastern Alabama region explored different STEM fields through hands-on activities. My first year, I co-led an interactive exhibit on cryptography at which students encrypted their own message and then decrypted a friend's message. The following year, I led an exhibit on subdivisions of polyhedra where students reconstructed a polyhedron from a subdivision that I had designed and 3D printed.

I also joined the Auburn Mathematical Puzzle Challenge (AMP'd) where 97 middle school students from the Auburn-Opelika area competed in solving mathematical puzzles designed by graduate students at Auburn University. I helped supervise and advise one of the problem rooms as well as run a table during the "Black-Market Barter" event. Beyond expository events like Destination STEM, these kinds of outreach activities also bolsters students' perceptions of mathematics and catalyze their desire to pursue STEM education.

Service

• **Improving the student experience.** I worked with Dr. Melinda Lanius and fellow graduate student Haile Gilroy to create and validate the CAAT (course alignment analysis tool), a mathematically based tool that measures how well an assignment reflects proposed learning objectives. When analyzing the impact of the CAAT on the perception of uniform homework, we found that the CAAT affected particpants' definitions of homework quality. Especially with novice instructors, the CAAT shows promise as a professional development tool as it quantifies the alignment between proposed versus assessed learning objectives.

• **Fostering connections between groups.** Throughout my years at Auburn, I also served as a representative for my cohort on our department's Graduate Student Council. My duties included organizing social events, responding to graduate student concerns and questions, and serving as a liason for my cohort to higher administration. I helped to organize the department's weekly tea where graduate students, faculty, and staff could meet informally in our department lounge over some tea and cookies and chat.

• **Organized graduate student seminars.** Throughout my graduate studies, I also led and encouraged mentorship among peers. My first year, I led a seminar for graduate students in my cohort to share their research from their undergraduate studies or to share some topic they were excited about. This not only served to build a common ground between all of us, but also to get a head start on practicing giving seminar talks and expositions on mathematical material to an audience. The following summer, I helped organize a reading course for graduate students in algebra where each week one student would present and field questions about one of the chapters in the book.

Software Development

A substantial part of my research process involves computing examples and formulating conjectures based on the patterns found in the examples. On my website, I have code repositories that host some of the code I have developed in my research. Aiding my research, the use of software such as Python and Macaulay2 is invaluable to this process. Since software development is crucial to my mathematical research and its efficacy in modern mathematics is growing, I will continue to contribute more software to the Macaulay2, Python, and SageMath ecosystems.

• **Macaulay2 packages.** I helped develop the `MatrixSchubert` package for Macaulay2 which implements methods for constructing and investigating matrix Schubert varieties, and have written the `Permutations` package to implement built-in support and routines for permutations in Macaulay2. Both packages are available in the most recent version of Macaulay2.