

# Program in Mathematical Methods in the Social Sciences

# 2020–21 Year in Review

**Northwestern**

WEINBERG COLLEGE OF ARTS & SCIENCES

Program in **Mathematical  
Methods in the Social Sciences**

**[mmss.northwestern.edu](http://mmss.northwestern.edu)**

# Welcome Letter from **Director**



**Jeff Ely**

Dear MMSS Community:

A social scientist sees a global pandemic from an academic perspective. It puts to the test institutions that we always took for granted. It shines a light on our reliance on social interactions and our uncanny ability to keep those interactions alive against all odds. And it suddenly and permanently alters our way of life, accelerating the arrival of the future.

One curious aspect of the pandemic I like to reflect on is how unusual it is for such a life-changing event to be such a mundane topic of conversation. No matter how dramatic, when we have all gone through pretty much the same experience, “you’ll never guess what happened to me!” just doesn’t quite fit.

But you might not know what a year of Northwestern MMSS pandemic life was like so I will give you a little glimpse. We welcomed the class of 2024 in our virtual Fall event on Zoom. The same faces we met were then variously re-arranged in their little boxes on screens for a year of advising, classes, and social events.

The MMSS lounge was vacant the entire year with the one exception of a student allowed in with an emergency need for computing resources due to a dead laptop on the eve of a due date. Nicole Schneider and I never set foot on campus the entire Fall and Winter quarters. In early Spring I finally met—in person—two students who had taken my

Winter quarter online Advanced Game Theory class. They told me how much they enjoyed the class. I could not recognize them.

Finally though, in June a fully vaccinated graduating class of 2021 and their families met in-real-life, for a moving graduation ceremony on the lakefill. We even had a few return from the class of 2020 whose graduation was entirely virtual.

And I am thrilled to tell you that the 2021-2022 academic year is pretty much back to normal, masks and occasional rapid testing being the only noticeable legacies. Here’s looking forward to a more normal Director Letter in next year’s newsletter.

I would like to close this letter with a heartfelt acknowledgement of the amazing contributions of Professor Mark Iris who will be retiring next year. His Police Projects have not only guided our students to an unforgettable research experience but also they put MMSS on the map as the unique program that combines frontier analytics with real-world policy impact. Thanks Mark and best wishes for your next adventures.

A handwritten signature in black ink, appearing to read 'Jeff Ely'.

Jeff Ely is the Charles E. and Emma H. Morrison  
Professor of Economics at Northwestern University

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## First Year Orientation Zoom and Peer Advisors



First Year Orientation typically serves as the initial gathering point for entering MMSS students. But 2020 was completely different with COVID as first-years had to start their college experience remotely. Program Director Jeff Ely and First Year Advisor Eric Schulz hosted orientation via Zoom and worked to answer the myriad of complex questions students had as well as talk through whether students might defer a year with the hope for a more normal start in 2021. The challenges of providing support to incoming students during COVID were immense. But we had the best Peer Advisor team with Alyssa Connor, Meghna Jain and Natalie Tomeh. They were our Most Valuable Players during this process as they went above and beyond to ensure students were connected and cared for as they registered for classes and navigated their first year at Northwestern.

## November Supreme Court Event



On November 17, Professor Ely presented a virtual seminar to Economics and MMSS students and alumni using his brand of game theory to talk about political polarization through the lens of the Supreme Court. Special thanks to MMSS 2004 alumnae Emily Engel for introducing Professor Ely's talk and facilitating the Q&A session. You can see a recording of the talk here (link below) and a short cartoon "trailer" for the talk here (link below)

Video link:

<https://economics.northwestern.edu/events/past-events/game-theory-and-decision-making/index.html>

Cartoon link:

<https://youtu.be/twWJ4YWmnR8>

Northwestern | Department of Economics  
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**Game Theory and Decision-Making:  
"Ruth, Anthony and Clarence."**

with Jeff Ely, Charles E. and Emma Morrison Professor;  
Director, Mathematical Methods in the Social Sciences Program

**Tuesday, November 17, 2020**  
**12:00 PM CT**  
**Via Zoom Webinar**  
**CLICK HERE TO RSVP**

year.in  
review

# April 29, 2021 Young Alumni Career Panel via Zoom



This is one event that may have been a bit better via Zoom as we were able to include alumni from outside the Chicago area. Five alumni panelists, who graduated between 2016 to 2019, provided insights and advice and questions were guided by an MMSS and Kellogg grad who served as our moderator.

Panel members gave their perspective on how to manage coursework, clubs, and various extra-curricular activities along with navigating the internship and job search. Alexandra and Mallika shared examples of how their more non-traditional MMSS second majors provided a unique perspective on problem solving and ultimately continues to give them a competitive advantage in their workplace. Ashley was surprised to find herself in the Tech/Supply Chain industry, but the Product Manager role has been a great fit for her skill set which has her translating between engineers and clients. Jonathan was just exiting the consulting biz for the Tech industry and credited his extra-curriculars and team-based work at Northwestern for providing the many skills he still uses today to stay nimble in this ever-changing job market. Hassan had a tremendous number of helpful hints on how to begin one's journey toward graduate schools and several students had follow up questions as they were intrigued by Hassan's positive and interesting experience as a professional student. Special shout out to Lilia who ensured many points of view were covered.



## Moderator: Lilia Kogan

Lilia Kogan is a program manager for Propel at Northwestern's entrepreneurship community The Garage. Since 2013, she has been a start-up investor and a member of Hyde Park Angels, a midwest-focused group. Prior to angel investing, Lilia had a career spanning healthcare, consumer and technology industries. She holds a bachelor's degree in MMSS and Economics from Northwestern and an MBA from the Kellogg School of Management.



## Mallika Bhandari

**Industry:** Consulting  
**Company:** BCG  
**Title:** Associate  
**Graduation Year:** 2019  
**Majors:** MMSS and English Lit; Certificate in Leadership



## Ashley Lloyd

**Industry:** Tech/Supply Chain  
**Company:** Fourkites  
**Position:** Product Manager  
**Graduation Year:** 2017  
**Majors:** Economics, MMSS; **Minor:** Film and Media Studies



## Jonathan Ni

**Industry:** Tech (previously Consulting)  
**Company:** DoorDash (previously Oliver Wyman)  
**Position:** Strategy & Operations, New Business Verticals  
**Graduation Year:** 2018  
**Majors:** MMSS, Economics, Statistics



## Alexandra Saldan

**Industry:** Data Science/Retail Media  
**Company:** 84.51°  
**Title:** Senior Data Scientist  
**Graduation Year:** 2016  
**Majors:** MMSS and Linguistics



## Hassan Sayed

**Industry:** Academia  
**Company:** Princeton University  
**Title:** PhD Student, Economics  
**Graduation Year:** 2019  
**Majors:** Econ, Math, MMSS

# Young alumni



# MMSS 2021 Senior Thesis Projects

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» The senior thesis is the capstone to the MMSS curriculum. It provides students the opportunity to draw upon the skills they have gained in class and apply them to a substantial piece of original research. During their junior year, MMSS students already begin to select a topic and advisor. As seniors, they work to refine their research question, complete any further data collection, and compile their analysis into a cohesive paper. Here are summaries of three research projects from the class of 2021:



## “Predicting The Popular Vote for United States Presidential Elections: Fundamental Variables Versus Political Variables”

by Valeria Werner with Advisor John Bullock

Valeria's thesis examined the power of election forecasting models. She set out to compare two approaches to vote forecasting. The first focuses on *fundamental* variables: those that reflect the current state of the economy and beyond and are independent of short-term political trends. One theory is that the fate of the incumbent is tied to these fundamental variables regardless of the political alignment of the candidates. The second theory assumes that political variables are predictive of elections. She collected data on 60 years of elections as well as a broad array of variables in both categories, including data on the state of the economy, mortality, and political approval ratings. Using an innovative two-step empirical approach Valeria determined that political variables alone can predict up to 75% of voting behavior, almost double the predictive power of models based on fundamentals.

## “The Impact of Social Gathering on the Spread of Covid-19”

by Viktor Tchaotchev with Advisor Gaston Illanes

How effective was social distancing at slowing the spread of COVID-19? This is a subtle question to approach using data because people make the decision whether to gather in groups based on risk levels in their community. A simple correlation between gatherings and subsequent spread might just be capturing those risk levels and not the causal effects. Victor used a clever instrumental variables approach using good weather as a proxy for the tendency to gather. Then by studying the correlation between weather patterns and subsequent spread Victor uncovered a surprisingly large effect. His thesis shows that lockdowns were a crucial mitigation tool.

## “The Efficiency of Chinese College Admissions Mechanisms: A Perspective from Matching Theory and Online Learning Algorithms”

By Yintian Zhan with  
Advisor Marciano Siniscalchi

More and more public school systems are using sophisticated algorithms for matching students to schools within a district. Game theory has been used to study whether these algorithms incentivize families to engage in manipulation by misreporting their rankings of schools. Yintian analyzed this issue in the context of China's nationwide college admissions process. He identified a key property of a matching algorithm, what he calls *sensitive-to-top-choice*, and he proves mathematically that it ensures a stable assignment of students to schools even when families strategize in their reported rankings of schools. Remarkably, the matching algorithm recently adopted in China to assign high school graduates to secondary schools and Yintian uses his results to compare the performance of this mechanism to a variety of alternative algorithms used in US school districts.

# senior thesis

# MMSS 2021

## Senior Thesis Projects



Senior MMSS student Asher Bornstein's thesis topic **"The Effects of the Chicago Public School Socioeconomic Tier System on Minority Enrollment at Top Selective Enrollment High Schools"** has local, real-world application for admissions policy decision making.

With guidance from Sociology Professor David Schieber, Econ Professor Scott Ogawa, and Econ Professor and MMSS Thesis Coordinator Joe Ferrie, Asher tackled the ever-pressing issue of school access and equality within the Chicago Public Schools (CPS).

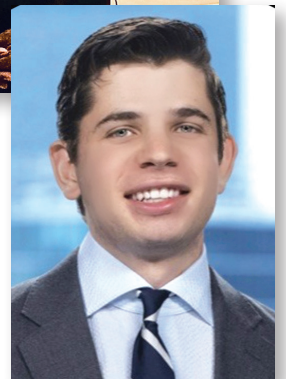
Since CPS implemented the race-neutral, socioeconomic tier system to determine admission into its selective enrollment high schools (SEHS) in 2009, the share of White students at the top five SEHS has increased while the share of Black students has declined significantly. The 2009 policy was originally put forth to counter the previous, race based, affirmative action system that was struck down by the federal courts. In the former system, White students were not permitted to make up more than 35% of available seats. But the reality of today's policy has White students taking up 38% of CPS's capacity.

Asher was able to craft a potential solution to this dilemma by including new socio-economic variables already available from the current census tract, and by re-weighting some of the socio-economic variables to help rebalance the racial distribution of admitted students. As a graduate of Walter Payton College Prep (a top CPS selective enrollment high school) himself, Asher was particularly interested in how diversity could be better achieved without compromising any of the academic standards of the enrollees.

The idea of bringing more equity without changing the admissions standards for any specific population also caught the attention of Northwestern's School of Education and Social Policy (SESP) Dean David Figlio, who helped make some introductions, and Asher was able to share his research with Chris



**Asher Bornstein with Speaker Welch at the Illinois House of Representatives**



Welch, Illinois Speaker of the House, to help advocate for more equitable enrollment policy within the Chicago Public Schools. "It was very exciting to discuss how my ideas can actually be implemented and more minority students can have access to the top five selective enrollment high schools in Chicago by tweaking the current tier system." He has since had conversations with members of the Chicago Board of Education and provided them with an executive summary, including models with specific numbers to show how re-weighting could bring greater equity and to help them advocate for better policies based on real-time data.

This story highlights one of the many ways the MMSS Program helps prepare graduates for any vocation due to the unique combination of rigorous math modeling and social science questions. Asher shares "As I reflect on my four years, the MMSS program has made me realize just how important mathematical modeling can be in helping to solve important issues on various levels."

## Police Project Updates



Since 1997, MMSS Lecturer Dr. Mark Iris has been advising MMSS students working on their senior theses. Building upon his experience serving as Executive Director of the Chicago Police Board, Dr. Iris uses extensive contacts to place students on research projects with major city police departments across the country. These agencies have massive amounts of data, but lack staff with the time and requisite skills to analyze those data and help these agencies better serve the public.

Over the years, teams of students have explored a variety of significant research questions posed by a number of police departments, among them New York City, Los Angeles, Houston, and Chicago. The students not only fulfill a key MMSS academic requirement, they also provide a valuable public service.

Students in essence serve as consultants, with the police department as the “client.” The project typically ends not just with the required senior thesis, but also a formal oral presentation to the command staff of the department.

This current academic year (2021-2022), Dr. Iris is supervising two teams. One group—Charis Lee, Timothy Lin, and Anthony Kim—is examining traffic stop data provided by the **San Francisco Police Department**—the first-ever MMSS/police data project in that city. They will parse those data to assess a crucial issue: whether there is a pattern of racial bias in police traffic enforcement efforts.

The second team’s students—Amanda Sugiharto, CJ Miller, and Samuel Junker—are working with the **Houston Police Department** (HPD). HPD very much appreciates MMSS’ efforts—this is the thirteenth project in Houston. These students are working with a massive data base to devise an optimal resource allocation model for HPD’s patrol officers. This human capital is an expensive asset. In a time of significant pressure on local budgets, ensuring these officers are most effectively deployed (in both time and place) is crucial.

COVID-permitting, these students, along with Dr. Iris and Senior Seminar Professor Joseph Ferrie, will return to San Francisco and Houston in May for the formal presentations of their research findings.

This will be Dr. Iris’ farewell to MMSS. He has been with WCAS since 1985. After teaching many courses for the Political Science Department (and also the Law School), and advising 136 MMSS seniors on 57 separate theses (four of which won the Dacey Prize for the best senior thesis), he will be retiring from Northwestern in June, 2022.



Graduating seniors Daniel Ross, Jacob Mandel, and Robbie Winter surprised their senior thesis advisor, Dr. Mark Iris, with a gift. The students’ thesis featured heat density maps of crime hot spots in Houston. The students had custom made neckties prepared, imprinted with one of those maps—but with the colors changed to Northwestern’s signature purple and white! At the June, 2021 MMSS graduation reception, the students and Dr. Iris all wore these matching ties—a striking MMSS fashion statement!

# police projects



# MMSS Senior Graduation Celebration— Classes 2020 and 2021

»»» If 2020 was a graduation to forget, 2021 was certainly one to remember! After a year of disappointments and virtual gatherings due to COVID restrictions, Northwestern allowed an in-person graduation celebration and both the Class of 2021 and 2020 were invited to attend.

On June 12, the MMSS seniors were invited to gather with their classmates and family for an afternoon reception to celebrate their undergraduate accomplishments. We met outside along the East Lawn facing the beautiful Lake Michigan. But major, unexpected storms started just as everyone arrived and Professor Ely was about to give his remarks. The Evanston Fire Marshal alerted Northwestern that the crowd needed to evacuate, and Norris personnel sent us inside to take cover—and we had to leave the desserts and refreshments outside to be pummeled by the rain and wind.

The professional photographer did not capture the chaos of the day, but it left an indelible mark on our MMSS community as we worked to salvage the party. Professor Ely did a valiant job rolling with the changes as he presented awards and shared highlights of the senior's thesis work. Just as we wrapped up the reception, the skies cleared way for sunshine and we were able to leave Norris and take some great pictures outside.

Congrats to the classes of 2020 and 2021! We know they will bring a critical yet humble world view to the next chapter of their personal and professional lives.



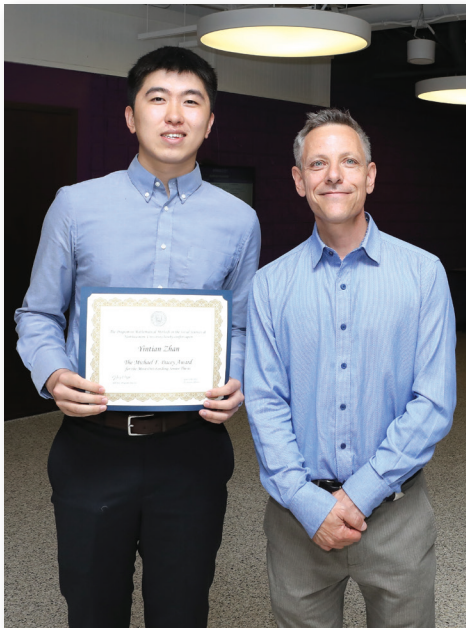
Above: Class of 2021 plus Nicole Schneider and Jeff Ely

Right: Jeff Ely addressing the Classes of 2020 and 2021 plus family and friends for the annual MMSS Graduation Reception.





# Jeanette M. Dacey and Michael F. Dacey Awards



Top: Jeanette M. Dacey Award for the Best Performance in MMSS Related Coursework – Class of 2021 – Yixin Zhou, Yintian Zhan, Jeff Ely, Jacob Mandel and Viktor Tchaouchev

Above left: Michael F. Dacey Award for the Most Outstanding MMSS Senior Thesis – Class of 2021 – Yintian Zhan and Jeff Ely

Above right: MMSS Award Winners for the Class of 2020 – Tina Zhang, Jeff Ely, Akshay Jain and Ryan Broll

Tina Zhang and Ryan Broll – Jeanette M. Dacey Award for the Best Performance in MMSS Related Coursework

Akshay Jain – Michael F. Dacey Award for the Most Outstanding MMSS Senior Thesis

graduation



# Class of 2020 **Returns**



Top: The MMSS Class of 2020 returns for a real celebration!

Middle row:

Jeff Ely and Ryan Broll  
Jeff Ely and Tina Zhang  
Jeff Ely and Jason Liu

Right:

Jeff Ely and Bobby  
Throckmorton



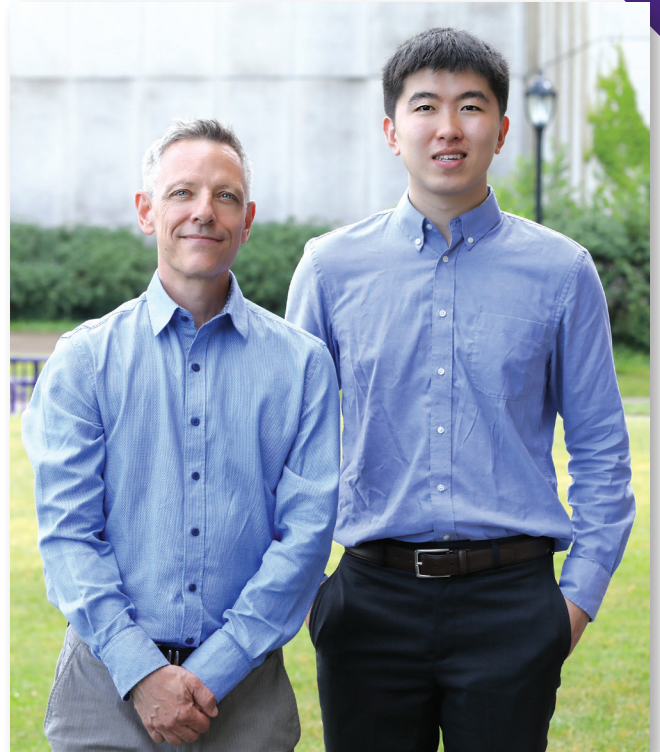


# Class of 2021

## Michael F. Dacey Award for the Most Outstanding MMSS Senior Thesis

Former MMSS Professor Michael Dacey and his wife Jeanette provided a monetary gift to both build a research fund in support of MMSS students as they completed their thesis and coursework, and award prizes for outstanding student accomplishments.

Senior MMSS Student Yintian Zhan received both Dacey awards in 2021—an unprecedented occurrence for our MMSS community! In addition, his paper was exceptional as there were a number of senior thesis projects that were considered for the prize but the faculty were very impressed with his clever ability to frame the research question, and the elegant approach he created through his use of algorithms. We are extremely proud of Yintian and all of the MMSS seniors and trust this spotlight will inspire future MMSS students to strive to produce thoughtful and novel research projects.



Jeff Ely and Yintian Zhan, MMSS Graduation,  
June 2021



Above: Class of 2021  
Graduate Valeria Werner  
and her family

Right: Grads and Dads



# Senior Profiles

## »»» Aaron Coates '21 Forecasting Analyst, BASES at NielsenIQ



### Why did you apply to MMSS?

I applied to MMSS because of the program's rich curriculum. I entered college with a range of academic interests, but I also knew that I wanted to study a quantitative major. MMSS was a perfect fit for me because the program's coursework allowed me to explore a wide variety of disciplines, including economics, sociology, and

political science. I appreciated that these courses were tailored for the MMSS program because in each course, we were able to focus on the modeling and statistical techniques utilized in the field we were studying.

### How has MMSS prepared you for Graduation?

MMSS has prepared me for graduation because the coursework has helped me develop my aptitude for modeling and analysis. In the job I've taken after college, I will use different modeling techniques every day to answer a wide range of questions relating to the consumer-packaged goods industry. Through the MMSS coursework and my senior thesis, I have developed a strong ability to understand all the moving parts and details that are involved in creating an efficient model, and this will certainly help me in my first and all future jobs throughout my career.

### What have you enjoyed the most about MMSS?

The most enjoyable part of MMSS has been getting to know the other members of my class. Some of my MMSS classmates have become my best friends, and it has been very meaningful to be able to experience all four years of college with the same people I met on the first day of freshman year. MMSS has given me close friendships and connections that I'm sure will last a lifetime!

## »»» Jessica Waldman '21 Student at Cardoza School of Law



### Why did you apply to MMSS?

Math was always my favorite subject in high school, but I struggled to see how it was applicable to the "real world." When it became time to apply to college, I wasn't sure what I wanted to study until I discovered Mathematical Methods in the Social Sciences while scrolling through the majors Northwestern had

to offer. As I read about MMSS it seemed like a perfect way for me to learn about different applications of math and ultimately became my primary reason for the "Why Northwestern?" essay question.

### How has MMSS prepared you for Graduation?

MMSS taught me many valuable skills in addition to, and arguably more important than, the material we covered in class. The demanding material taught me how to think critically, manage my time, work with others, advocate for myself, work hard, and so much more. I am confident these skills will benefit me wherever I go after graduation.

### What have you enjoyed the most about MMSS?

My favorite part about MMSS was the community that I formed with my cohort. Beginning freshman fall, since our MMSS classes were an hour apart, most of us would get lunch together a few times a week. In the quarters that followed my MMSS friends became some of my closest friends at Northwestern. There is something truly special about the relationships that form from having so many classes with the same people and needing to work together and rely on one another.



**Ethan Zack '21****Software Engineer at Wolverine Trading****Why did you apply to MMSS?**

I applied to MMSS because I knew it had all the elements of a program I would love. Math had always been my favorite subject in high school—I made it a goal of mine to take the most challenging classes from the most challenging teachers at my school. For the most part, I thoroughly enjoyed this endeavor; however, I didn't find some classes to be directly applicable to the "real world." While reading about MMSS, I knew that it would provide me opportunities to learn my favorite subject of math through different real-world-applicable contexts such as econometrics and game theory. In other words, I knew that it would fill the void that I found in some of my high school classes, which got me very excited as I was applying to the program. After completing MMSS, I'm thrilled to say that it didn't disappoint! The professors were excellent, the subjects were relevant and compelling, and the other MMSS students were helpful and considerate. I'm really looking forward to using the skills that MMSS has taught me as I enter my first full-time job!

**How has MMSS prepared you for Graduation?**

MMSS has prepared me for graduation by providing me with a valuable skill set that I will use as I enter the workforce. It has taught me not only how to strongly navigate numerous technical fields such as thesis writing and data modeling, but also how to think about common topics such as voting methodology and decision-making through unique analytical perspectives. As someone entering a technical financial field, I anticipate these all being valuable—and necessary—skills. I'm grateful to have learned them through the rigorous and thorough MMSS curriculum; I am now confident that I am prepared for nearly any technical challenge post-graduation.

**What have you enjoyed the most about MMSS?**

My favorite part of MMSS was the community. I made my best friends at Northwestern through MMSS. We spent countless hours studying for exams together, working on problem sets together, and having productive debates and discussions about MMSS-related topics. In my experience, everyone in MMSS wanted everyone else to succeed. Everyone was open for questions and help—the entire senior MMSS class had a group chat where we would discuss topics and review material. Overall, my memories working with MMSS peers are among my favorites at Northwestern.

# young alumni

# Alumni Resources

## Thank You to Our MMSS Alumni Supporters

▶▶▶ No other undergraduate program in the nation matches the scope, advanced level or degree of integration of social sciences and mathematics. We are thankful for the support that has allowed us to make sure MMSS students are well prepared for the future—whether going on to the graduate school of their choice, being highly sought by Fortune 500 employers, or bringing analytical rigor to traditionally less data-driven fields.

## Donating to MMSS

▶▶▶ Donations from our loyal and generous alumni help ensure that the MMSS Program continues to provide vital resources to our students such as statistical software licenses, periodic replacement of computer hardware, support for senior thesis research, community building events and more. Donations to MMSS have a positive impact on the Program's intention of providing a rigorous learning experience within a supportive and resourceful community.

## Nathan Carl Popkins MMSS Legacy Fund

▶▶▶ In addition to a gift to the MMSS Program, alumni and friends can also direct support to The Nathan Carl Popkins MMSS Legacy Fund. This fund was established in 2018 in honor of late MMSS alum Nathan Carl Popkins '01, who embodied a drive and love for math in all facets of his life. In that spirit, the Popkins Legacy Fund is the first permanently endowed fund exclusively dedicated to enhancing the experience of the MMSS students and building a strong, tight knit community of scholars for years to come.

You can designate gifts directly to MMSS through this secure link:

<https://giving.northwestern.edu/MMSSnews>

Or if you are mailing in a check, please include MMSS or the Nathan Carl Popkins MMSS Legacy Fund on the memo line.

## Stay Connected

Due to the MMSS Program's selectivity, the student body is small by design and the average graduating class is 32 students. Since the first students graduated in 1981, there have been approximately 1,300 MMSS alumni. Here are some key ways this community can all stay connected:

### LinkedIn

With over 800 members in our "MMSS Northwestern Alumni" LinkedIn Group, it can be a great resource for connecting. To join, visit our LinkedIn Group [here](#), email [mmss@northwestern.edu](mailto:mmss@northwestern.edu), or search for "MMSS Northwestern Alumni" on LinkedIn.

### MMSS Mentorships

Sign up to serve as an MMSS mentor through [Northwestern Network Mentorship Program](#).

### Alumni Profiles

Send an update to [mmss@northwestern.edu](mailto:mmss@northwestern.edu) and provide an alumni profile on how MMSS has impacted your life.

### Year In Review

Sign up to receive this annual newsletter by sending an email to [mmss@northwestern.edu](mailto:mmss@northwestern.edu).

## MMSS Contacts

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