CornellEngineering
Operations Research and Information Engineering

ORIE

Newsletter
Winter 2020

ORIE PROGRAM AT CORNELL TECH THRIVING

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Since July 2019, I have had the profound honor of serving as the Director of the School of ORIE. I assumed the reins from Professor Shane Henderson, who worked tirelessly to hire new faculty (both in Ithaca and New York City), increase the size of our Ph.D. program and create new educational programs.

I recall sitting in the director's office with Shane explaining many of the challenges of being director. How will we maintain close ties to Cornell Tech? How can we administer Master of Engineering programs across two cities? What might we magnify and what might we change in our undergraduate curriculum to ensure our students are prepared for the exciting, data rich environments of the future (or the present)? These were all challenges I felt prepared for. Quite obviously, none of us were ready for the COVID-19 pandemic. Aside from the horrific impact infection has had on some of the students, faculty, staff and their families, it has forced us all to perform our roles remotely. I am so proud of the work our faculty and staff have done to reimagine courses for virtual instruction. I am equally proud of our students for persevering through this unfortunate circumstance. Hearing story after story of Cornellians donating supplies to hospitals, lending their expertise, and helping those in need highlights what a caring, compassionate, and enduring community we are.

For those with questions about how Cornell is dealing with the pandemic, I encourage you to stay updated through the coronavirus links on cornell.edu and engineering.cornell.edu, respectively.

This issue's lead article profiles ORIE's presence in New York City—in Cornell Tech and in Cornell Financial Engineering Manhattan (CFEM). We are doing great things in the Big Apple. It is time to fill you in on what's been going on with our faculty and students.

ORIE continues to chalk up success after success. Assistant Professors Sid Banerjee and Nathan Kallus each won the prestigious CAREER award from the National Science Foundation last year. These research grants are highly sought after and are a true badge of distinction. Well done, Sid and Nathan! Recent past winners of CAREER awards include Associate Professor Andreea Minca and Assistant Professor Jamol Pender.

This past year ORIE hired Professor Katya Scheinberg away from her chaired professorship at Lehigh University. She is a world leader in optimization and machine learning. In addition, we hired two highly distinguished Professors of Practice, Oktay Gunluk and Marco Lopez de Pardo, that will further strengthen ORIE's already formidable presence in the practice of operations research.

Speaking of practice in operations research, the winner of the "Silent Hoist and Crane" award in the College of Engineering is one of our Master of Engineering project teams. The team developed software tools, with built-in optimization (of course), to help with Women Swimmin'—an annual fundraiser that supports Hospicare here in Ithaca. It is gratifying to see projects of significant social value being recognized in this way.

Over the past year we bade farewell to three mainstays in the department; Professors Bob Bland (see page 14), Jack Muckstadt, and Sid Resnick. Their dedication to the educational mission of the department is undeniable. The good thing (for us) is that retirement does not mean they ride off into the sunset. Visit the department on any day, and you are just as likely to catch them in their offices talking to students and mentoring faculty (including me!).

ORIE is, in some ways, bursting at the seams. Our Ph.D. program currently has 54 students. At last year's graduation we hooded seven newly-minted Ph.D.s, and this fall we welcomed 12 new students, eight of whom are women! We also welcomed one of our largest Master of Engineering classes ever. That was not quite planned, but our yield went through the roof last year. I guess we are doing something right! Our undergraduate numbers are holding steady at around 80 students per year, with affiliations for next year still to be finalized.

Despite the challenges, it has been an exciting year of transition and growth. As always, we are up to it and optimistic for what comes next! Please take care of yourself and those around you by practicing social distancing and following the recommendations of the Centers for Disease Control and Prevention.

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ON THE COVER
An aerial view of Cornell Tech on Roosevelt Island in New York City.

THE ORIE MISSION
The School of Operations Research and Information Engineering's mission is to host research programs, a full spectrum of educational programs, and industry outreach activities spanning its eponymous domain.

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CHECKING IN ON ORIE @ CORNELL TECH

When Huseyin Topaloglu, professor in Operations Research and Information Engineering (ORIE), moved from Ithaca to New York City in the summer of 2015, he brought with him 13 years of experience at Cornell and a big task: laying the foundation for ORIE programs at the nascent Cornell Tech campus.

Born out of a competition by then-Mayor Michael Bloomberg for a new applied-science institution, which Cornell won in 2011 with partner Technion–Israel Institute of Technology, and housed on Roosevelt Island since September 2017, Cornell Tech is charged with helping to diversify the city's economy after the financial crash of 2008.

Under the leadership of Laibe/Acheson Professor of Business Management and Leadership Studies David Shmoys, who served as school director at the time, and Kathryn Caggiano, Professor of Practice and director of the ORIE M.Eng. program in Ithaca, Topaloglu set to work on one of ORIE's key offerings in New York, the Master of Engineering (M.Eng.) in Operations Research and Information Engineering program. "We've had a lot of fun building a new academic program from scratch," Topaloglu said. "Usually you don't get this kind of luxury anywhere." Thinking about the right kind of OR program for the Tech Campus, they looked to the needs of industries working with big data. "The idea is that mathematical algorithms, large-scale computation, and heaps of data come together to solve business problems and drive business decisions," he said.

The first class of eight students arrived in the fall of 2016 to tackle such questions as how much stock a company such as Amazon should keep, what types of ads Google might place next to a search, or what movies Netflix could recommend to a user.

Cornell Tech fosters creativity and collaboration among students and faculty.

"Part of what we do in research directly translates into practice, and what we find in practice relates back to our research. This is a required part of being at Cornell Tech."

—Professor Huseyin Topaloglu

Since then, the faculty has grown to comprise assistant professor Nathan Kallus, an expert in data-driven optimization, including decision making, causal inference, machine learning, and personalization ; as well as professor Itai Gurvich, who specializes in performance analysis and optimization of human-operated processing networks, the theory of stochastic-process approximation and the application of operations research and statistical tools to healthcare processes. Charles H. Dyson Family Professor of Management Garret van Ryzin, who focuses on algorithmic pricing and marketplaces, is an ORIE field member at Cornell Tech.

"Being a small place, we're trying to cover a lot of ground with a small number of people," Topaloglu said. What they have in common is an interest in industry engagement, as well as methodological research and institution building. "Part of what we do in research directly translates into practice, and what we find in practice relates back to our research," Topaloglu explained. "This is a required part of being at Cornell Tech."

Another required part is attending ORIE faculty meetings on the main campus via teleconferences and participating in all department business, such as hiring decisions. "Intellectually, we're present in Ithaca all the time, though we may only physically visit a couple of times a semester," Topaloglu said. "We're one department."

People

M.Eng. students 2019/2020:	51
Ph.D. students:	7

Faculty
Huseyin Topaloglu, *Professor*
Itai Gurvich, *Professor*
Nathan Kallus, *Assistant Professor*
Garret van Ryzin, *Charles H. Dyson Family Professor of Management*

Our Programs

Master in Operations Research and Information Engineering

When Topaloglu and his colleagues the new Cornell Tech ORIE M.Eng. program, they knew it would have one important aspect in common with its Ithaca counterpart: "Like any other good master's program in OR, we make sure the students understand the mathematical foundations of optimization, probabilistic modeling and machine learning extremely well," he said. "These are our three technical pillars, and we do not sacrifice anything in terms of depth."

But while the main campus degree focuses more heavily on building OR-related math and engineering skills and offers a third-semester option for the financial engineering concentration, Cornell Tech gives its two-semester ORIE master's program a decidedly entrepreneurial bent, attracting individuals with an interest in very large-scale computation and learning how to use mathematical models to inform business decisions in uncertain environments. "This doesn't mean the students have to be interested in starting their own companies, but they should have a natural inclination towards building products—whether an algorithm, software, or a process," Topaloglu explained.

Students practice applying their skills in two of Cornell Tech's signature Studio courses—cross-disciplinary team experiences with members from across the diverse campus. In the Product Studio in the fall, they solve a real-world challenge offered by a business or non-profit with a digital product, service, or strategy. Choosing between Startup Studio and BigCo Studio in the spring, students then create their own startup or lead innovation within a large, existing company under the guidance of C-suite or VP-level company advisor. In all three courses, the process of assembling work groups, hashing out plans, preparing pitches, and presenting products gives them a taste of how teamwork and leadership function in the real world.

Trained to help technology-driven businesses make sense of vast amounts of data, ORIE M.Eng. graduates have gone on to join major technology, consulting, and quantitative marketing companies and several hedge funds.

ORIE Ph.D. program

Unlike the Masters program—and like its overarching school—the ORIE Ph.D. program spans the Cornell Tech and Ithaca campuses, offering a unified curriculum in separate locations. "At the Ph.D. level, there's absolutely no distinction," Topaloglu said. "It's a research-based program, students are supposed to create new knowledge—their advisors just happen to be in New York."

All students begin their studies in Ithaca with a year of foundation courses and may opt to spend the following summer in the city to test out working with a Cornell Tech faculty member. "If the relationship is good, if they like it here, I usually like to send them back to Ithaca to take a second year's worth of courses, and we keep the relationship alive through long-distance research and regular visits to the city," Topaloglu explained. "If at the end of the year they're really interested in working with an advisor in New York, we ask them to relocate here full-time."

Once at Cornell Tech, doctoral students continue to engage with their colleagues in classes that are broadcast from the main campus and vice versa, and they may even access courses at Columbia and New York University through an informal arrangement with individual faculty members.

While there is no requirement that doctoral research have an entrepreneurial angle, some students tap into Cornell Tech's broad array of resources and their proximity to New York's wealth of businesses. Topaloglu's Ph.D. advisee Mika Sumida, for example, took her work on dynamic resource allocation to food delivery company Homer Logistics (later acquired by Waitr) for a summer, spending a day a week at its offices. "She got field data, and she made an impact in the company," Topaloglu said. "Things like this certainly happen here."

Students study, mingle and head to classes at the Cornell Tech campus in New York City.

FEATURE: ORIE @ CORNELL TECH

CFEM CONTINUES STEADY GROWTH AT CORNELL TECH

The discipline of financial engineering owes its beginnings to Cornell. Pioneered in Ithaca in 1989, it became formalized as the Master in Engineering with Financial Concentration (MFE) degree within ORIE in 1995—and has only grown since.

Expanded to three semesters in 2007 and moved to the Cornell Tech campus a decade later, the program now complements a year of broad theoretical foundation in quantitative finance on the Ithaca campus with an optional summer internship in the city, and a final semester at Cornell Financial Engineering Manhattan (CFEM).

"The Master of Engineering is effectively a professional degree, not a theoretical degree," said Victoria Averbukh Ph.D. '97, Professor of Practice in ORIE and director of CFEM since its inception. "We are committed to giving our students tools and skills that can make them useful from the first day that they're on the job."

To that end, CFEM places its students as close as possible to the pulse of the finance industry through internships, hands-on projects, and close interactions with experts in the field. All courses are led by practitioners, including those taught by in-house faculty. Averbukh spent the decade after earning her Ph.D. in ORIE on Wall Street, working as a fixed income strategist for Salomon Brothers (later Citi) and Deutsche Bank, while her colleague Sasha Stoikov, senior research associate and head of research in the program, has worked as a consultant for the Galleon Group and Morgan Stanley and as a VP at Cantor Fitzgerald.

"This semester we're offering five courses that are taught by people that actually work during the day and then come to teach in the evening on what they do during the day," Averbukh said. "They're all fairly senior experts in their respective fields."

The program's specific offerings change dynamically with the needs of the financial industry. "In the last 10 years, our focus has shifted from modeling of complex financial derivatives with limited financial data to the study of more liquid assets at a higher frequency, using data science and machine learning tools," Stoikov explained.

As a result, students attracted to CFEM now are more likely to be motivated by programming and statistics than the aspiring traders of the past. The majority of this year's incoming class (38 of 53) chose to opt into the program's Financial Data Science certificate, launched in spring 2016.

Wherever students' interests lie, "we have made our curriculum extremely flexible to allow them to tailor their coursework to fit their background and career goals," Averbukh said. Only two courses are required: Like other M.Eng. students in ORIE, CFEM aspirants complete a project, working in teams of six to solve a real-world problem posed to them by a company. "They are advised by faculty like myself, produce a final report and present their work to the sponsor," said Stoikov. "It is a big part of their grade, and sometimes sponsors hire some of the student."

The more traditional route to a job is through the mandatory professional development course and associated workshops and boot camps. "Our students understand that having strong technical skills, while extremely important, is not enough to be successful in the industry," said Liz Drummond, associate director of career development. "Effective communication and networking are essential components to their success. Our programming helps to foster these abilities, so that our graduates are able to jump-start their careers."

Professor of Practice Victoria Averbukh

Indeed, CFEM's statistics speak for themselves: the program consistently places 100 percent of students in summer internships and 95 percent or more of freshly minted financial engineers in jobs—mostly in New York City or the United States—within six months of earning their degree. (Career support continues even after graduation.)

Networking through happy hours, the annual Quant Finance Forum, an advisory council, Women FIRE Chat, or the recently started ambassador program keeps alumni involved in CFEM. Perhaps some of them will be recruited by Averbukh to teach courses in the future, keeping the curriculum current and completing the circle.

By Olivia M. Hal

ORIE WELCOMES CHRISTINA LEE YU

Christina Lee Yu joined the ORIE faculty in July 2018. The goal of Yu's research is to design scalable statistical algorithms for processing social data based on principles from statistical inference.

"I am excited to be at Cornell," says Yu. "I really enjoy that Cornell's Operations Research school is very open-minded and interdisciplinary, with faculty working at the intersection of statistics, computer science, machine learning, economics, and applied math. Boundaries between disciplines are not drawn too closely here, which gives me flexibility to explore research in many different directions."

Yu earned her undergraduate computer science degree from the California Institute of Technology. "Caltech was perfect for me," says Yu. "It was a small school with a narrow focus on math, science and engineering, and I was given a lot of flexibility to choose courses across different departments. I was able to take a mix of CS, Electrical Engineering, and applied math courses that were tailored to my interests—it was the ideal mix to prepare me for research."

During her junior year at Caltech, Yu worked with Professor Adam Wierman on a summer research project. "That research experience with Adam changed my perspective," says Yu. "It helped me see that maybe I could do research and it could be fun." The research Yu did as an undergrad involved matching markets and social networks. "Wherever you look, there are complex networks," says Yu. "For example, there are biological networks, transportation networks, communications networks, social networks. They are all intricate and patterned and seem unique, yet they share common properties. I applied to grad schools thinking I wanted to look deeply at why these networks seem to have so much in common."

Yu received her M.S. and Ph.D. in electrical engineering and computer science from the Laboratory for Information and Decision Systems (LIDS) at the Massachusetts Institute of Technology (MIT). When she got to MIT her focus shifted to more of an engineering approach. "I started to ask, 'How can we engineer optimal algorithms to perform inference over networks? Can we compute global properties of the network using local algorithms that can only see a small portion of the network at a time?'" says Yu. Her work addressed fundamental questions like "What's the minimum amount of data one needs to collect before being able to infer the underlying structure or pattern in a dataset?" and "What types of statistical assumptions on your data do you need to guarantee provable results for a recommendation algorithm?"

In deciding between academia and industry, Yu recalls "I once heard a faculty member say 'While one can also produce great research in an industry lab, the goal of research in academia is not only the research itself, but in the process to train students. In some sense, this makes the primary product of academia the students." That made a lot of sense to me, and resonated with my passions. I'm excited that academia offers a unique opportunity to make impact through mentoring and teaching students."

Immediately before starting at Cornell, Yu held a postdoctoral researcher position at Microsoft Research New England. At Cornell, she has several lines of research underway. "One of the questions I am asking," says Yu, "is 'How do you deal with interdependence or correlations in your data? Since data is collected over time and recommendations are made sequentially—how can we account for the historical dependencies between the data we collect and the recommendations we make?'" Other areas that Yu is interested to explore include fairness in algorithms and designing recommendations for healthcare data.

Assistant Professor Christina Lee Yu

By Chris Dawson

ORIE FACULTY NEWS

KATYA SCHEINBERG JOINS ORIE FACULTY

Katya Scheinberg has joined the faculty of Operations Research and Information Engineering. Scheinberg was previously the Harvey E. Wagner Endowed Chair Professor at the Department of Industrial and Systems Engineering at Lehigh University. She was also co-director of the Lehigh Institute on Data, Intelligent Systems and Computation. She started at Cornell in July of 2019.

The first female to hold the rank of full professor in Cornell ORIE, Scheinberg grew up in Moscow, Russia. Her parents met at Moscow University, where they were both studying mathematics. Originally, Scheinberg thought she would blaze her own trail and become a medical doctor, but then she realized how much memorization that involved and she changed course. "At 14 I started at a high school that specialized in math and physics," says Scheinberg. "I was with a very select group of students and that experience was life-altering. One of my teachers there told my parents that it would be a waste if I didn't go into mathematics, which was surprising and encouraging because many of my classmates were stronger in math."

So rather than studying medicine, Scheinberg pursued undergraduate studies in computational mathematics and cybernetics at Moscow State University. "As I started college," says Scheinberg, "I assumed I would become a programmer. I didn't really consider being an academic researcher. The attitude then was that women in STEM should get a job and contribute, but that they would never be serious researchers."

The Soviet Union was then in the midst of some major structural and attitudinal changes. One result of these changes was more students were allowed to go to the west for graduate studies. "This really affected my career choices," says Scheinberg. "It meant I could get a Ph.D. and follow a different path." In her fourth year, Scheinberg began working with Arkadi Nemirovski and Yurii Nesterov and she was introduced to the idea of continuous optimization. Nemirovski saw promise in Scheinberg and wrote a letter of recommendation supporting her application to a Ph.D. program at Columbia University.

Scheinberg moved to New York and earned her master's and doctorate in operations research from Columbia working in the lab of Professor Donald Goldfarb. She then took a position in IBM's T.J. Watson Research Center as a research staff member, where she stayed for 12 years. "Working at IBM was a lot like having a very long postdoc," says Scheinberg with a smile. It was near the end of her time at IBM that Scheinberg started work on a book called *Introduction to Derivative Free Optimization*, co-authored with Andrew R. Conn and Luis N. Vicente.

Shortly after the publication of her book, Scheinberg left IBM and joined the faculty of Lehigh University as a professor in the Industrial and Systems Engineering Department. In 2014 she became the Wagner Professor at Lehigh and in 2015 she and her co-authors won the Lagrange Prize in Continuous Optimization for *Introduction to Derivative Free Optimization*. In 2019 Scheinberg was awarded the Farkas Prize by the Optimization Society in the Institute for Operations Research and Management Science.

At Cornell, Scheinberg plans to continue her work related to developing practical algorithms and their theoretical analysis for various problems in continuous optimization, such as convex optimization, derivative free optimization, machine learning, and quadratic programming. Some of her recent research focuses on the analysis of probabilistic methods and stochastic optimization with a variety of applications in machine learning and reinforcement learning.

Professor Katya Scheinberg

By Chris Dawson

Tardos received Amazon Research Award


Éva Tardos

Professor Éva Tardos received an Amazon Research Award for her proposal "Economic Inference and Algorithmic Learning in Games."

This work was based on classical work on the economic analysis of the interactions of strategic agents starts with players that have valuations for outcomes. Take for example items or sets of items a player may win in an auction. The analyzes yields an equilibrium for the result game where each player optimizes their strategy to improve their outcome. To empirically test the prediction of such a theory, one needs to understand what are the valuations of the players. Classical analysis of game outcomes relied on the notion of Bayes Nash equilibrium in multiple ways, both in analyzing outcomes, and inferring the user's types or valuations from the observed data. However, the assumption that these data are generated by the equilibrium behavior of the players is often unrealistic.

The main challenge considered in Professor Tardos's proposal is the dynamic nature of the on-line environment. Typical games describing on-line environments, including internet ad auctions, are best thought of as repeated games, where participation and the strategies of agents evolve over time. Participants in such dynamic environments are best modeled as learners, agents that use available data to update their strategies over time. The focus of the proposed project is understanding outcomes and inferring player's properties and these algorithms.

AQR's Marcos Lopez de Prado joins CFEM faculty


Marcos Lopez de Prado

Marcos Lopez de Prado joins Cornell Financial Engineering Manhattan as a Professor of Practice after leaving his post at AQR as Principal and Head of Machine Learning.

"We are delighted to welcome Marcos at CFEM. He has been instrumental in developing and advancing our Financial Data Science certificate, and he brings over 20 years of quant experience into our classroom," said Victoria Averbukh, Director of CFEM.

Before formally joining CFEM, Professor Lopez de Prado taught his graduate course "Advances in Financial Machine Learning" as a CFEM practitioner since 2016. Marcos has been named "Quant of the Year 2019" by *The Journal of Portfolio Management*.

Banerjee, Kallus Receive NSF Awards


Sid Banerjee


Nathan Kallus

ORIE assistant professors Siddhartha Banerjee and Nathan Kallus are among five faculty from Cornell to receive National Science Foundation (NSF) Faculty Early Career Development Program awards.

Over the next five years, each researcher will receive up to $500,000 "to build a firm scientific footing for solving challenges and scaling new heights for the nation, as well as serve as academic role models in research and education," according to the NSF website.

Banerjee's work revolves around understanding how data, machine learning and markets can be used to control "smart systems" such as cloud platforms, transportation, smart grids and financial networks. All of these systems face Professor Tardos's of making decisions with incomplete information and strategic agents. Banerjee's aim is to develop a theoretical framework for real-time decision-making, and create algorithms that make use of historical data, simulation models and market mechanisms. He will also test these algorithms in collaboration with industry partners in on-demand transportation, cloud computing and financial technology, as well as the local food bank.

Kallus will investigate how to train algorithmic decision systems from observational data in sensitive applications where reliability and fairness are of concern. Observational data, which have become plentiful in domains such as medicine, lack experimental manipulation so causal effects are obscured by a phenomenon known as confounding, and such data are also otherwise messy, noisy, biased and often missing. Therefore, the project's goals are to develop a methodology for efficient and fair learning that is by design robust to these issues as well as theory providing guarantees of reliability.

ORIE FACULTY NEWS

PROFILE: MARK E. LEWIS, HONORED IN MATHEMATICALLY GIFTED & BLACK


Mark E. Lewis

Where are you from?

Niceville, Florida

Please describe an experience (or 2) that helped you discover/ cultivate your interest in the mathematical sciences.

I have had many influences and mentors through the years. Each helped me continue to progress from where I was to the next phase. My mother and father were (and continue to be) my strongest advocates. When we arrived in Florida from the northeast, they fought to have the schools allow me to work at my own pace. I had a long series of excellent teachers who treated me like they would have any of my white counterparts. I graduated from high school with a solid mathematical base. From there I again found the Mathematics department at Eckerd College to be a place of exciting and deep exploration. At that time, my professors exposed me to research and allowed me to take specialized courses in combinatorics, real analysis, operations research and partial differential equations. I do not know how often the professors there are still able to teach those courses (the classes were small), but for me it was a rich and inclusive environment to learn. In graduate school (at Georgia Tech) I was involved with research year round. My thesis advisors provided the "guided freedom" I needed and the Cooperative Research Fellowship Program at Bell Labs gave me access to some of the world's premiere researchers in the summers. Lastly, I spent a year as a postdoctoral researcher at the University of British Columbia. After having always been told what the next thing is, my postdoc advisor, pointed me in a direction and set me up for an independent research career.

What is/are your most proud accomplishment(s) in regards to your career in the mathematical sciences?

Each promotion breaks down a new wall. I was the first African-American hired in Industrial Engineering at Michigan, the first tenured in my current department (Operations Research and Information Engineering (ORIE)), the first African-American Senior Associate Dean for Diversity and Faculty Development in the College of Engineering, etc. So, I guess I would say that the proudest professional accomplishment is the latest one. By the way, we have since hired the second African-American in ORIE. I would like to think that my being here in some small way was a catalyst for the second hire.

What is/are your most proud accomplishment(s) in regards to your personal life?

I married the person whose opinion I respect the most. Virtually every decision I make starts with a consultation with her. We have two daughters whom I hope look up to me.

Please share some words of wisdom/inspiration.

The study of the mathematical sciences has always broadened opportunities, but with the technological advances of today and in the future, the potential will continue to magnify. Perhaps most importantly, these opportunities are diverse. With a focus on the sciences we can continue to cultivate role models to work in the tech industry, as entrepreneurs, at predominantly white institutions and historically Black universities (to name a few possibilities).

The added challenge of being Black while pursuing a career in the mathematical sciences continues to be real, but it might be good to know that you need not be a pioneer. You are not alone.

On a personal level, while I think most about encouraging African-Americans, if following my path inspires anyone to do anything positive, my struggle is justified.

CELEBRATING BOB BLAND: BOB'S LAST LECTURE

Bob Bland with University of Toronto Professor Joselh Milner '89.

Former students traveled from as far as Bogota, Honolulu and Paris to be on campus June 6, 2019 for a celebration of the retirement of Robert G. Bland and his designation as Professor Emeritus. They joined colleagues and friends of Bland for a program of fond reminiscences and for "Bob's Last Lecture," a light-hearted compilation of some favorite moments from his 2,500, or so, lectures at Cornell.

Bland received his B.S. in 1969 and his Ph.D., under D.R. Fulkerson, in 1974, both in ORIE. He returned in 1978 as Assistant Professor and Sloan Foundation Fellow after appointments on the mathematics faculty at Binghamton University and the Center for Operations Research and Econometrics in Belgium. Bland was promoted to Associate Professor in 1981 and Professor in 1987, and served as Undergraduate Director, Graduate Director and Director of ORIE. Bland received three Outstanding Educator awards from Cornell, two Professor of the Year selections by the ORIE undergraduates, and the College of Engineering McCormick Advising Award, named for Bland's classmate Jim McCormick '69 and his wife, Marsha.

Bland taught thousands of Cornell undergraduates and graduate students and made major research contributions in combinatorial mathematics and operations research. One of the inventors of the theory of oriented matroids, he developed axiomatizations to reveal the mathematical foundations of linear programming duality. This led him to a refinement of Dantzig's simplex method that guarantees finite termination by imposing a priority for pivot selection based on ordering the variables. This mechanism, now known as Bland's Rule, provides an elegant constructive proof of the strong duality theorem of linear programming. Joint work with Cornell OR Ph.D. students, including celebration participants Brenda Dietrich '86, David Jensen '85, Chun Ko '91, Jon Lee '86, and David Shallcross '89, made further contributions to duality theory and optimization.

Bland applied OR to Cornell and the local community. With OR Professor David Shmoys and Dmitriy Levchenkov Ph.D. '07, he developed an integer-programming approach to scheduling Cornell's final exams that was used for seven years and generated a unanimous proclamation of thanks from the Student Assembly.

His 2005-2006 M.Eng. project team of David Rimshnick, Sebastien Desfrisches-Doria, and Hector Espinoza helped Foodnet Meals-On-Wheels streamline the delivery of lunches to seniors in Tompkins County. The team's routing software saved 25% in fuel costs and even more on fleet maintenance. Foodnet used this software for 10 years to shrink the time window for deliveries from 4.5 hours to 2.5 hours, a big plus for Foodnet's clients for whom lunch was now delivered at lunch time!

Bob's Last Lecture

Bland began his lecture by defining his new title, Professor Emeritus: a professor who cannot recall where he parked his car. He went on to present highlights from some of his undergraduate classes.

Bland led the audience through a series of teaching examples based on real applications and emphasizing the importance of the information linear programming can provide when used for scenario analysis, not just as a one-shot tool for reporting an optimal solution based on fixed inputs. He included two large-scale exercises with real data and solved one with 600,000 decision variables in real time during the presentation.

To provide intuition for why integer linear programming (ILP) is so much more challenging computationally than linear programming, Bland discussed the non-convexity of ILP feasible regions and its implication for ascertaining whether a candidate solution is improvable. He illustrated with a photograph taken by a student in the Optimization I lecture on Halloween 2001 showing Bland, who was dressed as Dr. Seuss's Cat in the Hat, using the cat's ears as pointers to illustrate non-convexity of an example drawn on the board.

Bland touched on key ideas from the Game Theory course and showed two cartoons submitted by students Mark Vigeant ISST '11 (see photo) and Chang Min Oh '11.

Bland ended his last lecture with brief highlights from his popular course, A Mathematical Examination of Fair Representation, where approaches to legislative apportionment, some due to Alexander Hamilton, Thomas Jefferson and Daniel Webster, are examined from an OR/Math perspective.

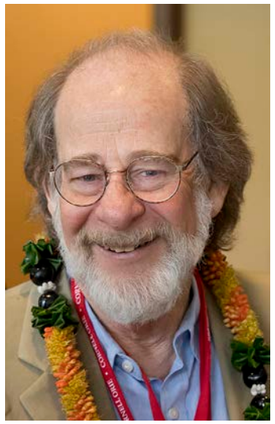
Bob Bland gives his last lecture June 6, 2019 in Statler Hall.

Reminiscences

Reminiscences by former students, colleagues and friends highlighted the celebration.

- ORIE's former Director David Shmoys recalled the 1978 lecture by his Princeton Professor Harold Kuhn on an exciting recent result—Bland's Rule. Shmoys said that lecture changed his life, revealing that mathematics was not complete or closed, but "vibrant and living," motivating a career in research and teaching. Shmoys recalled that Bland was instrumental in bringing him and his spouse, Éva Tardos —Cornell's Jacob Gould Schurman Professor of Computer Science—to Cornell.

Bob Bland makes a point during his last lecture.



Bob Bland at the luncheon celebrating his retirement.

- Vinod Mathew '97 described the "infectious joy" in Bland's teaching and its impact on him, his spouse Gladys Mathew '99 and his sister-in-law, Shanty Mathew Khurana '04. After he graduated, he and Bland supported one another through the illnesses and deaths of loved ones; he called Bland "one of the most wonderful human beings I have had the pleasure of knowing."

- ORIE Professor of Practice Kathryn Caggiano Ph.D. '98 has been ORIE's Director of M.Eng. Studies since 2007. In 1997, Bland, then Director of ORIE, created the College of Engineering's first Directorship of M.Eng. Studies. This position has been vital to the success of ORIE's M.Eng. program, Caggiano reported, and has been replicated throughout the College.

- Sam Schmitz '09 said Bland's optimization course was the reason he pursued operations research as a profession, and that as a mentor Bland "defined my time at Cornell."

- Lori Rosenkopf '84, Peter Rimshnick '05, and Adam Schneider '09 were Merrill Presidential Scholars who named Bland the faculty member who most significantly contributed to their Cornell experience. All three commented on Bland's inspirational role in their Cornell years and beyond.

- Eric Brown '88 M.Eng. '89 reported that the exercises in Bland's Discrete Models course taught him "two life lessons" that he brings "to any complicated project my colleagues and I are working on." One concerns the value of distilling from the technical analysis fundamental concepts that drive the outcomes and can be communicated in non-technical language. The second is the importance "first and foremost" of ascertaining at the start what form an answer should take, and what you need to know to get there. At Brown's request, Bland had replenished his mainframe computing account, but asked, "Are you sure you need more funds?" A week later, when Brown was about to ask for still more funds, he realized that the underlying message in Bland's question was, "You already have the answer, you just don't yet know

that you know it." Brown and his project partner were burning compute cycles in an attempt to find more efficient sequences for two expensive production technologies. However, they already had sufficient information from One-Tree Relaxation bounds and sequences already found to determine which technology to buy, the goal of the project.

- Joe Milner '89, Brown's classmate in Discrete Models, said Bland recognized him and Brown for outstanding project work with Minimum Maple Tree Awards, wordplay on the Minimum One-Tree construct used in the project. The award, a two-inch-high maple seedling, was replanted at Milner's family home and is now a mature tree.

- Chris Jones '80 M.Eng. '81 M.S. '83 Ph.D. '85 traveled from Bogota, where he works in digital trucking for Convoy—they operate a digital freight marketplace matching shippers with carriers. He harnessed concepts learned from Bland 40 years ago to determine how to significantly improve utilization. This led to a change in corporate direction and promises to be a win for shippers, truckers, Convoy and the environment, through reduction in emissions. Jones said it would not have happened had he not taken Bland's Graph Theory and Network Flows: "when Bob teaches something, it stays taught."

- Participating by video: Kalifa Pilgrim Hill '04 M.Eng. '06 from Shanghai, China, where she manages Schlumberger's facility; Major Zak Dentes '09, USMC, from Okinawa, Japan; Jon Lee '81 Ph.D. '86, the University of Michigan Johnson Professor of Engineering, from Oberwolfach, Germany; and Ozlem Ergun '96, from Northeastern University, where she is Professor of Industrial and Mechanical Engineering.

Other contributors included Mayur Khandelwal M.S. '01, Oscar Bernal '09 M.Eng. '10, Mark Eisner Ph.D. '70, Robert Blau '67, M.S. '71, Ph.D. '75, and ORIE Professors Emeriti Michael Todd and Leslie Trotter, Jr. Many more students and friends attended, including Bland's freshman roommate, Mike Natan '69. Some of Bland's former students brought spouses, children and parents to meet Bland and attend "Bob's Last Lecture."

By Mark Eisner

Dedicating a Research Study

Bland's celebratory day began with the private dedication of room 314 in Olin Library as the Robert G. Bland Research Study. The ribbon cutting at the opening of the study, "Named in honor of a devoted professor who inspired two generations of Cornell students." Observing are Peter Rimschnick '05 M.Eng. '06 and University Librarian Gerald Beasley.

Another Olin Library research study, room 615, is named for ORIE Professor Emeritus Leslie E. Trotter, Jr. Trotter placed one of Bland's contributions in a broader context at the dedication:

Bob and I have maintained a close relationship as friends and colleagues since we first met as graduate students here at Cornell almost 50 years ago. Throughout that time I have drawn significant motivation and inspiration from his work. Of particular note in this regard is his criterion assuring finite termination of the simplex algorithm for linear programming: variable selection at each algorithmic decision point should respect an (arbitrary) initial ordering of the problem variables. While I was initially impressed purely by its technical content, it took me many years to appreciate that this result also provides fundamental insight into intellectual reasoning. How? In my high school Latin class I learned the phrase ***simplex sigillum veri*** *(simplicity, the sign of truth), a principle I often invoked later in explaining to students that basic understanding in scientific/technical reasoning always follows the simple path. Bob's work on simplex algorithmic finiteness clearly adheres to this principle, and is all the more impressive as it comes some 30 years after the initial presentation of the simplex algorithm. After returning to Bob's work many times (each time I taught ORIE 320/3300) it finally became evident to me that its inherent beauty offers the deeper lesson* ***simplex sigillum elegantis****: simplicity reveals not only truth, but also elegance in reasoning. The significance here rests with the broadening of applicability from scientific/technical disciplines to areas such as visual art and design, enunciation of a principle which spans many fields of intellectual endeavor. I attribute my own realization of this principle to Bob's work, and thus regard his work as a contribution touching the very essence of the University's defining mission* ***towards unity****.*

ORIE FACULTY NEWS

Pender receives COE diversity award

Assistant professor Jamol Pender received Cornell Engineering's 2019 Zellman Warhaft Faculty Commitment to Diversity Award.

Established in 2007 in honor of mechanical and aerospace engineering professor Zellman Warhaft, the first associate dean for diversity in the College of Engineering, the Zellman Warhaft Faculty Commitment to Diversity Award recognizes students and faculty members for commitment to diversity issues, as well as participation in Diversity Programs in Engineering activities and programs.

Pender's primary research interests involve the stochastic analysis and optimal control of queueing networks with time varying rates. Often valuable information about the queueing system can be lost or delayed and he is interested in how this loss or delay of information impacts the dynamics of queueing networks. Pender is also broadly interested in the applications of queueing networks in the study of service systems, collaborative economies, smartphone networks, healthcare, and transportation systems.

Jamol Pender

Cleaning Up Big, Messy Data

Messy data—heterogeneous values, missing entries, and large errors—is a major obstacle to automated modeling. Data cleaning is the first step in any data processing pipeline, and the way it's carried out has serious consequences for the results of any subsequent analysis. Yet this step is generally performed using ad-hoc methods. The simplest approach to coping with missing data is also the most common. Many researchers just ignore any datum with a missing element. In settings where most data is present, this practice results in decreased statistical power; in settings where most data is missing, this practice is disastrous and renders the data useless.

Along with her team, ORIE's assistant professor Madeleine Udell is developing basic, composable modeling tools for robust data inference by exploiting structure in the data set. Their modeling framework will accept data with noisy, uncertain, or missing values, and will produce clean, complete data sets. This framework will automatically extend any other modeling tool to work on highly incomplete, noisy data. The research involves developing novel algorithms for denoising and imputing missing data by exploiting spatiotemporal, network, and low dimensional structure to infer missing values in complex, heterogeneous databases.

Madeleine Udell

These methods of preprocessing data will allow researchers to draw power from the data that they do have and to perform any kind of analysis they normally would perform on complete data. Applications range from social science surveys to medical informatics, from manufacturing analytics to marketing, from finance to hyperspectral imaging, and beyond.

ORIE STUDENTS HELP OTHERS GROW & FIND SUCCESS

As Andrew Daw first approached the gates of the Cayuga Correctional Facility in Moravia, N.Y. in January 2019, he felt a bit daunted. This was, after all, his first experience with prison. But unlike the inmates he was about to meet, the Cornell doctoral student was here voluntarily and free to leave a few hours later. He had come to teach introductory college-level math to a classroom of some of the most grateful students he would ever encounter.

Daw is one of several ORIE graduate students who have been reaching out beyond the comforts of campus to share lessons in mathematics and critical thinking with prisoners in the region and throughout the United States. While Daw has been visiting nearby correctional facilities through the Cornell Prison Education Program (CPEP), fellow fifth-year Ph.D. student Sam Gutekunst has spent the past two semesters developing a math textbook for Prisoner Express (PE), a mail-based program also housed at the University.

"People in prison are bored, lonely, and think they're going crazy, they feel like they have nothing of worth to do," said Gary Fine, program director at Durland Alternatives Library (DAL) and founder of PE. "When you offer them the combination of stimulating material, plus people who care, it gives them a lifeline to grab onto."

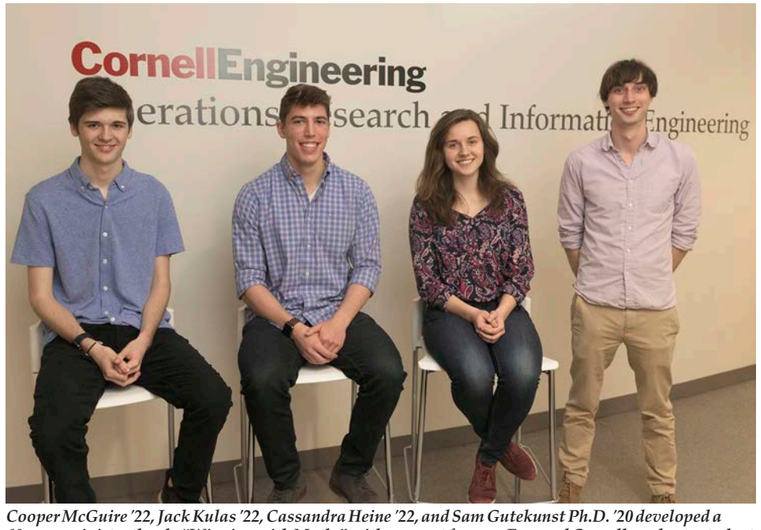
Fine emphasized that prisoners represent society's full range of intellectual abilities and education, from early learners to individuals asking for college-level physics textbooks. However, many find math especially challenging.

Students such as Daw and Gutekunst are happy to help. "Education is one of our best tools for self-improvement," Daw explained. "I've been fortunate to have had incredible access to learning throughout my life, and that's led to me finding a subject I'm passionate about. I'm lucky to get to share that with others."

Daw joined CPEP—whose mission includes providing high-quality higher education in New York State Prisons and helping to improve prisoners' lives and their chances for re-entry into civic life—after completing his A exam (which is required of any graduate student teachers). His Contemporary Mathematics course is one of about a dozen options offered every semester by a variety of Cornell faculty and graduate students, supported by undergraduate teaching assistants. Their students—prisoners in four regional correctional facilities—may earn liberal arts credits towards a Certificate in Liberal Arts from Cornell or a SUNY Associate in Arts degree.

Over two semesters, Daw has taught more than two dozen men, ranging from his own age to older than his parents. "For many of these students, this is their first math class in a long time and often one of the key remaining requirements for their degree," he said. Daw's approach to conveying the building blocks of quantitative reasoning—such as set theory, geometry, probability, and statistics—in the prison classroom is much the same as on campus. "The primary difference, though, is that my interaction with the class is only through the weekly three-hour lecture period," he said. "There are no office hours, no Blackboard, no e-mail. The challenge in teaching is being prepared for anything that could happen that week, because otherwise it has to wait a week more."

Working within such constraints has made positive outcomes all the more meaningful. "I think the most rewarding part is watching these students encourage one another while working on problems at the board. You both get to see the joy someone experiences when figuring something out and to witness a person's peers actively lift him up and recognize him for an achievement," Daw said." In general, these are some of the most engaged students I've ever been around, and that's a sentiment that's quite common among CPEP instructors. Seeing their fear about learning math transition to an open excitement for solving problems is a special experience I'll carry with me from my time at Cornell."



Cooper McGuire '22, Jack Kulas '22, Cassandra Heine '22, and Sam Gutekunst Ph.D. '20 developed a 60-page mini-textbook, "Winning with Math," with support from an Engaged Cornell graduate student grant.

Daw's students, however, are a rarity. In the United States, few prisoners have access to post-secondary education programs such as CPEP. According to a report titled "Investing in Futures" and released earlier this year by the Vera Institute of Justice and the Georgetown Center on Poverty and Inequality, in 2014 (the most recent data available) only nine percent of prisoners earned a college or trade school certificate while incarcerated, and fewer than half of prisoners completed any education program at all.

In fact, DAL director Fine learned that many prisoners lack access to even more basic resources, such as books, and may experience long days of isolation. When a prisoner wrote a letter 15 years ago requesting reading materials, Fine sent out his first shipment of books—and Prisoner Express was born. Today the volunteer-based program supplies some 4,000 prisoners across the country with books, a newsletter of each other's writings and art, a journal program, and distance learning courses.

PE's newest offering is Gutekunst's "Winning with Math." Nominally a math course, it is designed to teach broader principles of abstract reasoning and critical thinking by examining how groups of people aggregate preferences to make decisions—specifically, how different methods of voting, allocating resources to states, and drawing political districts can lead to different outcomes, and how tools from Operations Research help us decide what methods to use. "This is a topic that fits nicely into operations research, because the math doesn't have a high barrier to entry, but you can see how seemingly small choices can have profound impacts," said Gutekunst. "Sometimes they can literally shape the balance of power, but they're also relevant any time a group of people comes together to make decisions—from a college admissions committee, to a board of directors, to how Netflix recommends movies."

"When you offer them the combination of stimulating material, plus people who care, it gives them a lifeline to grab onto."

— Gary Fine
Program Director
Durland Alternatives Library,
and Founder of Prison Express

Gutekunst developed the 60-page mini-textbook with support from an Engaged Cornell graduate student grant and three undergraduates he had taught previously in an introductory operations research class, then-first-years Jack Kulas '22, Cooper McGuire '22, and Cassandra Heine '22. Once the lessons ship to some 600 inmates by the end of the year, the team hopes its prisoner students will respond to some of the included open-ended questions and engage in follow-up correspondence. "It will be extremely rewarding to get answers back from inmates, to see how they felt about the program, and also to see how they're applying the ideas to their own lives," Gutekunst said. He expects additional useful data from a 1,000-person survey the team designed to improve PE's operations and document its impact.

For Gutekunst, PE's positive effects reach beyond prison. "One of the things that's been really cool about working on this project is the potential for it to have a formative impact on my undergraduate students' trajectories," he said. "The project lets them explore operations research ideas they might never have heard of before, helps them develop as technical writers, and lets them—as freshman—share what they've learned with over 600 readers."

His students, in turn, appreciate what they have gained from this work. "My involvement with the project has made me more conscious and thankful for my own education and more cognizant that other people may not enjoy the same opportunities and privileges I have had," said ORIE major Kulas, who presented a poster about this work at the Joint Mathematics Meetings in January with his teammates. "I definitely want to continue working on projects where I can give back and help motivate others to find their full potential. At the beginning of my freshman year, I could not even imagine working on a project this impactful under such a willing and helpful mentor."

And if past experience—and data from the "Investing in Futures" report (see link below)—is any guide, the educational opportunities Gutekunst, Daw, and others create can profoundly alter the outlook and post-incarceration lives of prisoners who receive them. "They start to realize, "I'm not crazy, prison's a crazy-making place," Fine said. "It gives them hope that there's a world out there for them."

By Olivia M. Hall

Interested in learning more?
https://experience.cornell.edu/opportunities/cornell-prison-education-program
https://prisonerexpress.org/
https://www.vera.org/publications/investing-in-futures-education-in-prison

PAMELA BADIAN-PESSOT: APPLYING MATH TO REAL-WORLD PROBLEMS

Pamela Badian-Pessot and Opal

Pamela Badian-Pessot's parents met while they were earning graduate degrees at Stanford University. It may be because of this that Badian-Pessot thought of graduate school the way many people think of college. "Growing up, I just always assumed that I would go to graduate school," she says. But then as she neared the end of her undergraduate degree programs in mathematics and economics at Wells College, she was a little less certain.

"When I was an undergrad I had an REU (Research Experience for Undergraduates) at North Carolina State University," says Badian-Pessot. "And while I was there I saw a panel discussion where an NC State grad student talked about having done a one-year post-baccalaureate program at Smith College in Northampton, Mass." Hearing that was all Badian-Pessot needed to check out the Smith College program for herself. She says, "I needed that extra year to really figure out what I wanted to do."

Her year at Smith convinced Badian-Pessot that a graduate degree program should be her next step. Of course, the next questions to answer were 1) what to study?, and 2) where to study it? As an undergraduate at Wells, Badian-Pessot had been introduced to operations research as a field of study and it clicked with her. She knew she wanted to apply the math she was learning to real-world problems. As for where to study, "I was not convinced I could get into Cornell, but several people at Smith convinced me I should try. When I got in, it was an easy decision to come to Ithaca."

Badian-Pessot in now in the fifth year of her doctoral studies in Operations Research and Information Engineering (ORIE), working with her advisor, professor and school director Mark Lewis. One line of Lewis's research focuses on using Markov-decision processes to optimize queueing policies. Badian-Pessot is trying to find optimal policies for data centers with energy-use considerations. "Some of these large data centers have many servers, but not all of the servers are needed all of the time," she explains. "With my work I want to help these centers answer a basic, yet very important, question: 'when should we turn some of these servers off?'"

Queues are modeled by a stochastic process. This means that the changes in them occurs randomly. Because of this randomness, it can be extremely tricky to prove that a particular control policy is actually the optimal one. Markov-decision processes provide a framework to analyze these processes. Badian-Pessot, in a recently published paper, has done just that. The paper, "Optimal control policies for an M/M/1 queue with a removable server and dynamic service rates," was co-written with Mark Lewis and Professor Douglas Down of McMaster University in Hamilton, Ontario.

"Even though the process we used sounds like the most intuitive process, it took a couple of years to prove the result," says Badian-Pessot. "Intuition is not always the best yardstick when it is a Markovian process you are looking at."

Badian-Pessot is planning to graduate with her Ph.D. in applied probability and statistics in 2020. Her work thus far has been fairly theoretical, but "I don't want to do theory forever," says Badian-Pessot. "I want to go into industry when I graduate, but I am not sure which one yet." One of the many benefits of an advanced degree in operations research is its applicability across broad range of fields.

When she is not busy thinking about stochastic processes and how best to manage them, Badian-Pessot spends time on the extensive and challenging indoor climbing wall at Cornell. She is also a huge baseball fan, having spent some of her time at Smith College helping to write a book chapter on the current state of analytics in baseball.

By Chris Dawson

STUDENTS' SOFTWARE OPTIMIZES LOGISTICS FOR WOMEN SWIMMIN'

If you are a fan of logic problems, you have probably seen some variant on the classic challenge involving moving a group of people or items from one place to another in the most efficient way possible, given several constraints.

Sometimes the challenge is framed as getting a group of people across a single-track footbridge where certain individuals can never be on the bridge together; sometimes it involves transporting animals across a river with a canoe, but certain animals can never be together on one side of the river without a human there.

If you have seen these sorts of problems, then you have just the slightest taste of what it might be like to organize the yearly Ithaca Hospicare event called Women Swimmin.'

Hospicare and Palliative Care Services is a real treasure in Tompkins and Cortland Counties, providing support for those with life-limiting illness and focusing on comfort and quality of life for individuals and their family caregivers. Hospicare serves more than 500 local families every year.

Women Swimmin' has been Hospicare's signature fundraising event since its start in 2004. It brings in roughly $400,000 annually, which is about half of Hospicare's philanthropic fundraising total each year. It is an event participants look forward to every August. Registration fills up quickly, with many women swimming year after year.

Which brings us back to that logic problem…more than 300 women register to swim 1.2 miles across Cayuga Lake, from the East Shore to the Ithaca Yacht Club. (It is not a race; rather, it is a community swim.) 200 boaters in kayaks and canoes track the swimmers and accompany them across the lake. Another 150 volunteers are on either shore, supporting the swimmers before they enter the water and as soon as they step out. There are five busses to shuttle swimmers and volunteers from one shore to the other.

To keep everyone safe and ensure things run smoothly, swimmers enter the water in "pods" of about nine. Pods are formed keeping in mind swimmer speed, swimmer preferences for whom they swim with, and swimmers' preferred start time. The busses that shuttle swimmers vary in capacity. And there is only one spot for busses to turn around in over on the East Shore—and only one bus can use the turn-around at any given time.

In the past, one woman has been responsible for working out the devilishly complicated logistics of forming the pods for Women Swimmin'. Jane Powers, senior extension associate in Cornell's College of Human Ecology, has been solving this complex logic problem year after year for 15 years. "Over the years I developed this complicated system involving names on slips of paper and paper plates spread all around the room," says Powers. "I've had people say 'Hey—I'll help you with this,' but it's not really something anyone could help with." Each of those paper plates represented a pod. And before a name was put on the plate, Powers had to consider that swimmer's speed, preferences for swimming partners, and preferred start time.

In the past couple of years, Powers ditched the plates and started to use her computer for this chore, but it wasn't much less time-consuming or difficult than her old method. "I did progress eventually from paper plates to working

From left, Betsy East, co-chair of Women Swimmin' and former associate dean of student services at Cornell Engineering; Jane Powers, Women Swimmin' pod coordinator and senior extension associate in the College of Human Ecology; Julie Langenbacher, former Women Swimmin' coordinator; and Jen Gabriel, director of development and community relations for Hospicare, which the annual event benefits.

"This is a great experience for us. We have a client and we have to deliver something good and useful. It's more real than simply writing code for a class assignment—this is for real people and will make a difference right away." "

—Maria Salvador Masip M.Eng. '19

with an Excel document—to sort, and categorize the swimmers into pods," says Powers. "But it was all in my head—and used my own crazy coding and categorizing strategies."

When there are 300+ swimmers you can imagine that the pod possibilities quickly become mind-bogglingly complex. Yet somehow, Powers managed year after year to get everyone into a pod and onto a bus and into the water without any major hitches. "It was hours and hours and hours of work each year…and as you can imagine after hearing the process I used, there was no easy way anybody could help me with it."

Until now.

Women Swimmin' 2019 marked the first year that an algorithm assigned women to pods and busses. No more plates, no more marathon logistical nightmare sessions for Powers.

At the start of the 2018-19 academic year, the Operations Research and Information Engineering (ORIE) Master's of Engineering (M.Eng.) program invited 12 companies and groups from the Cornell and Ithaca communities to present challenging projects to this year's ORIE M.Eng. students.

Betsy East, Co-chair of Women Swimmin' (and past Associate Dean of Student Services at Cornell Engineering) heard about this call for projects. She remembered when ORIE M.Eng. students helped create an algorithm to effectively place all 800 first-year engineering students into sections of the required ENGRG 1050 class as well as assigning them to faculty advisors. East thought this might be something worth pursuing, so she told Powers about the call for projects.

Powers, along with East, described the logistical challenges of the Women Swimmin' event to a roomful of M.Eng. students and several Cornell faculty. One of these faculty members, Professor David Williamson, also said a few words to the students about the good work done by Hospicare.

"I left that day thinking that none of those students would want to work on our project," says Powers. "So many of their other options were working alongside corporations, so I thought they would gravitate to those sorts of things. I was shocked when we got chosen!"

Swimmers and their boating escorts prepare to leave the east shore of Cayuga Lake for the1.2 mile swim to the Ithaca Yacht Club.

Four of the students in the room that day have created a team, along with ORIE faculty advisors David Williamson and Assistant Professor Christina Lee Yu. Team member Maria Salvador Masip says, "This is a great experience for us. We have a client and we have to deliver something good and useful. It's more real than simply writing code for a class assignment—this is for real people and will make a difference right away." Judy Zhou, another member of the team, says, "Optimization skills are useful in so many areas. This Hospicare project will give me a deeper understanding of what's involved and at the same time will help Hospicare organize the Women Swimmin' event much more efficiently."

Professor Williamson added, "This is a great experience for the M.Eng. students because it gives them practice at a skill they will need often in their careers. If you have a client who is not technical, you have to be able to hear their needs, translate those needs into an optimal technical solution, and then translate what you have done back in a language and procedure the client can understand."

"This is uncharted territory for me," says Peter Haddad, a senior mechanical engineering major who is earning his ORIE M.Eng. degree simultaneously. "As an undergraduate, I have had very little experience with optimization. This project is forcing me to keep up to speed with everything and giving me a chance to apply it right away." Michael Lapolla, the fourth student member of the team, agrees with Haddad. "It is great to have a chance to apply what I have been learning in classes—to get to see how this all works out in the real world."

By Chris Dawson

The 2019 edition of Women Swimmin' was the most successful yet, both in terms of number of participants (340) and money raised ($410,000). The algorithm created by the M.Eng. students, while very helpful in organizing the complicated logistics of the event, will be tweaked for next year in an effort to make it even better.

ORIE ALUMNI SUPPORT THE SCHOOL ON CORNELL GIVING DAY 2020

The School reached out on Cornell's Giving Day 2020, and ORIE alumni responded with more than $24,000 of support! We are grateful for each gift, which we see as a vote of confidence. These flexible dollars will allow department leadership to take advantage of emerging opportunities and fill funding gaps in the coming year. If you haven't visited the page please do so to watch the video and hear about what we have been up to (https://givingday.cornell.edu/campaigns/cu-operations-research-and-information-engineering).

What is Cornell Giving Day?

On Cornell Giving Day each year, alumni, friends, and Big Red fans all over the world come together to make a difference for Cornell and for the world. All gifts made on March 12, 2020, between 12:00 a.m. and 11:59 p.m. EDT, were counted toward Cornell Giving Day totals.

DEVELOPING CORNELL ORIE: FUNDRAISING PRIORITIES

Investment in ORIE by alumni allows faculty to continue shaping brilliant young minds in innovative ways. In recent years, we have developed a list of high-level fundraising priorities to continue to develop the school. If you would like to talk about how you can make a difference for our students and faculty, please contact ***Tony Simione in ORIE AAD at 607-255-1288 or ams637@cornell.edu.***

Capital Projects – You can help develop space for our doctoral students, or support Ph.D. students' connections with faculty by sponsoring a series of faculty/student lunches.

Faculty startup and endowment – Alumni can support hiring new faculty by helping with recruitment and start-up costs, or by endowing a named professorship.

Graduate Fellowships – Ph.D.s and M.Eng. students thrive with fellowship support. Gifts to funds that support students (current use or endowment) help keep graduate students' debt low, and allow us to recruit the best.

Support inspired thinking – With your help we can better support and develop two big-picture opportunities for our students: the Distinguished Lectureship Series and the Data-Driven Decision-Making Workshop. Both of these programs bring together leading minds to engage faculty students to key elements of the intellectual landscape.

CornellEngineering
Operations Research and
Information Engineering

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