

## Operations Research Center

The [Operations Research Center \(ORC\)](#), established in 1953 as a first-of-a-kind interdepartmental graduate degree program, completed its 64th year of operation in academic year 2017. ORC administers both its own graduate program and a varied research program of methodological and applied projects.

This report summarizes ORC's AY2017 activities and briefly reviews the center's educational, research, and outreach programs.

### Faculty, Students, and Staff

Professor Dimitris Bertsimas and Professor Patrick Jaillet continue to serve as co-directors of ORC.

During AY2017, ORC had 51 affiliated faculty and two staff members. Faculty were drawn from the MIT Sloan School of Management and the Departments of Electrical Engineering and Computer Science, Civil and Environmental Engineering, Economics, Mathematics, Aeronautics and Astronautics, Mechanical Engineering, Nuclear Science and Engineering, and Urban Studies and Planning.

ORC offers two interdepartmental graduate degree programs, a doctorate and a master's degree program. During the past year, these programs enrolled 86 students; there were 75 PhD candidates and 11 SM candidates. ORC conferred five master's degrees and 12 PhDs. Several other PhD theses were in the final stages of completion in summer 2017.

ORC had an outstanding year in terms of yield in admissions. The center received 263 applications for the doctoral program and made 22 admission offers, 11 of which were accepted. There were 85 applications for the SM program; ORC made seven offers of admission, five of which were accepted. Three National Science Foundation (NSF) predoctoral fellows are now enrolled at ORC.

ORC's graduates continue to find exceptional jobs in both academia and industry. This year, graduates found positions as assistant professors at the University of California at Berkeley, Stanford University, the Georgia Institute of Technology, the University of Michigan, and the University of Chile.

### Academic Programs

The ORC's academic programs continue to be recognized as ranking among the very best, both nationally and internationally. Moreover, the programs are repeatedly described as achieving an excellent balance between application and methodological domains.

### Research Activities

Research activities spanned a wide spectrum of methodological topics and applications, ranging from small, unsponsored projects involving one faculty member supervising a student's thesis to larger sponsored programs involving several faculty, staff, and students.

On the methodological side, there has been an increasing emphasis on the interface between machine learning and optimization, including data-driven optimization and algorithms for convex, discrete, stochastic, and robust optimization. On the application side, the emphasis has been on the interface between personalized medicine, operations management, and pricing. More, ORC faculty continue to contribute to application domains as wide-ranging as manufacturing, communications, transportation, public services, logistics, marketing, financial services, and health care.

Several organizations sponsored research projects at ORC during AY2017, including NSF, the Ford Motor Company, MIT's Charles Stark Draper Laboratory (Draper Fellowships), the US Food and Drug Administration, General Motors, Accenture, MIT's Lincoln Laboratory, the Office of Naval Research, Sapient Corporation, Mitsubishi, and the Singapore–MIT *Alliance* for Research and Technology (SMART).

### **Outreach and Professional Service**

During AY2017, ORC held a number of faculty meetings to discuss issues pertaining to the center. Topics included:

- The visibility of ORC
- Updates on the new master of business analytics degree program
- ORC's interactions with industry
- Updates on admissions

### **Seminar Series**

ORC's weekly seminar series was privileged to have many distinguished speakers from industry and academia this year. The operations research professionals who made presentations included Santanu Dey (Georgia Institute of Technology), Andrea Lodi (University of Montreal), Olivier Toubia (Columbia Business School), Patrice Marcotte (University of Montreal), David Matteson (Cornell University), Daniel Granot (University of British Columbia), Vahab Mirrokni (Google Research), Colin Fogarty (MIT), Anton Kleywegt (Georgia Tech), Nathan Kallus (Cornell University), Pierre L'Ecuyer (University of Montreal), Yash Kanoria (Columbia University), Giacomo Nannicini (IBM), Nikolaos Trichakis (MIT), Peng Sun (Duke University), Dawn Woodard (Uber), Jose Zubizarreta (Columbia University), and Shipra Agrawal (Columbia University).

ORC also offered, during the January Independent Activities Period, a full-day session on "Careers in OR and Analytics" in which a number of speakers focused on their work, research, and careers and then discussed the future of operations research. The speakers included Iain Dunning (DeepMind Technologies); Kris Ferreira (Harvard Business School); Gina Mourtzinou (Dynamic Ideas Financial LLC); Nataly Youssef (MyA Health); Rama Ramakrishnan (Salesforce); Brian Denton (University of Michigan); Bill Pulleyblank (West Point); and Dimitris Bertsimas (MIT).

## Student-Run Programs and Activities

ORC is very supportive of activities organized by the student chapter of the Institute for Operations Research and the Management Sciences (INFORMS). The student chapter held social events that fostered a feeling of camaraderie among students and helped to improve life at the center. These INFORMS events are often used as opportunities to meet students from other MIT programs. ORC is very proud of the friendly and inclusive environment the center fosters for its students. Student activities and events this year included:

- INFORMS Mexican and Indian cuisine lunches—opportunities for students to meet and explore the culinary cultures of some of their fellow students
- INFORMS Ice Cream Social—an opportunity for some stress relief for those students taking the qualifying examination
- Registration Party—an opportunity for students to meet and discuss the subjects for which they are planning to register
- ORC Reunion at the annual INFORMS Conference—the students arranged an informal “reunion” event that allowed current students to touch base with ORC alumni and alumnae
- Valentine’s Day Event—a social event put on by the INFORMS officers for student social interaction
- Social Fridays—a weekly gathering that encouraged all ORC students to get together on Friday afternoons. Other such events throughout the year included a Welcome Back Lunch and afternoon coffee and snack events.

ORC is also very proud of the work done by its student Resources for Easing Friction and Stress (REFS) volunteers. Student volunteers who complete training in conflict resolution and are familiar with other resources offered at MIT run this program. They make themselves available as moderators for conflicts and as confidants for students who may be experiencing difficulties. They have also begun meeting with each new student one-on-one just to check in and make sure every ORC student knows the REFS are there to help with any pressure or issues they may be having. Additionally, they have organized small lunches where ORC students can meet with ORC faculty members. They also organized events centered on reducing stress and tension. These include social events to increase awareness of the REFS program and to discuss student issues and concerns. The center finds the REFS to be an invaluable resource to students.

## Fellowships

ORC has received fellowship support from the Sloan School of Management for doctoral students. In addition, the center received an endowed fellowship (the Henry Gabbay Fellowship) from an ORC alumnus that partly supports an ORC doctoral student.

## Future Plans

The ORC programs have been expanding. ORC has increased its total number of enrolled students, and the new master's of business analytics program had its first class of 16 students in AY2017; they were given shared desk space at ORC. It is the center's hope that the interaction and collaboration between these new students and the current ORC students will be beneficial to all. These new master's students worked closely with companies as part of their program, which should result in improved visibility for ORC and possibly encourage research collaboration.

ORC also plans to encourage the student INFORMS chapter and the REFS students to continue planning social events and opportunities for students to help each other in their pursuits.

ORC also intends to play a larger role in analytics and statistics within the Institute. In this context, ORC offers the subject 15.071 The Analytics Edge and will offer 15.680 Machine Learning: Algorithms, Applications, and Computation in academic year 2018.

## Diversity

ORC has always attempted to provide an environment that is both responsive to the varied professional and personal needs of the operations research community at MIT and builds diversity. During AY2017, ORC's staff comprised one support staff member and one academic administrator, one of whom was a woman. As for the student population, 21 of ORC's graduate students were women. Over the past years, ORC has made efforts to attract qualified women and members of underrepresented minority groups to its graduate programs by targeting information to mathematics departments in liberal arts colleges and by sending information to historically black colleges and universities.

## Professional Activities and Awards

### Faculty

Daron Acemoglu has been named to the 2017 class of Andrew Carnegie Fellows, a prestigious honor supporting research in the social sciences and humanities.

Sinan Aral was appointed to serve on the Scientific Advisory Board of the Alan Turing Institute in London—the British national institute for data science, headquartered at the British Library. The seven-member Scientific Advisory Board, an independent group that provides strategic advice to the institute's board of trustees and leadership team on its research program, comprises experts from organizations around the world in academia, industry, and government, with a diverse range of skills and specializations spanning privacy, machine learning, engineering, microeconomics, and entrepreneurship. Aral also received the 2017 Jamieson Prize for Excellence in Teaching, established to honor educational innovation and excellence. This prize recognizes an educator's impact on the Sloan School through dedication, passion, innovative thinking, and unwavering commitment to students' learning.

Cindy Barnhart was awarded the degree of doctor of science from the University of Toronto, *honoris causa*, for her leading contributions to the field of operations research

and her outstanding service to her students and academic community. She was also elected to the American Academy of Arts and Sciences.

Dimitris Bertsimas was named the 2016 Distinguished Lecturer of the International Federation of Operational Research Societies. The award was presented at the 28th European Conference on Operational Research at the Poznań University of Technology, Poznań, Poland, on July 4, 2016. Bertsimas was also appointed editor-in-chief of the *INFORMS Journal on Optimization*.

Dimitris Bertsimas and Allison O’Hair, PhD 2013, were honored by being selected for the “Class Central’s Top 50 MOOCs of All Time” list, based on thousands of reviews by Class Central users. The subject that lay behind the award, 15.071x The Analytics Edge, was delivered via edX and ranked second in Class Central’s Computer Science/Data Science and Big Data courses. It was one of three MIT courses in the “Top 50 MOOCs of All Time” list. Bertsimas also received a Sloan School Outstanding Teacher Award for subject 15.727/15.071 The Analytics Edge, which he taught in 2017.

Vivek Farias and Devavrat Shah received the 2016 Best Operations Management Paper in Management Science Award from the Manufacturing and Service Operations Management Society of INFORMS. This award honors their contribution of an outstanding article, selected from among the prior three years of articles published in *Management Science*. Farias and Shah’s winning paper, co-authored with Srikanth Jagabathula (from New York University’s Stern School of Business), was “A Nonparametric Approach to Modeling Choice with Limited Data.”

Patrick Jaillet received a Ruth and Joel Spira Award for Excellence in Teaching from the School of Engineering. The award acknowledges “the tradition of high-quality engineering education at MIT.”

Retsef Levi and Tom Magnanti received the 2016 Harold W. Kuhn Award, an annual prize that recognizes an exceptional paper published in *Naval Research Logistics* during the previous three years. Their winning paper, co-authored with Jack Muckstadt (Cornell University), Danny Segev (University of Haifa), and Eric Zarybnisky (MIT), was “Maintenance Scheduling for Modular Systems: Modeling and Algorithms.”

Jim Orlin won the Test of Time Award from the Association for Computing Machinery’s Special Interest Group on E-commerce, which recognizes papers published between 10 and 25 years ago that have had “significant impact on research or applications that exemplify the interplay of economics and computation.” Orlin’s winning paper, co-authored with John J. Bartholdi III (Georgia Tech), is entitled “Single Transferable Vote Resists Strategic Voting.” The award committee characterized Orlin’s paper as being one of two that in many ways catalyzed an entire field, noting its influence on the subfield of computational social choice.

Carolina Osorio won the 2016 Outstanding Paper in Urban Transportation Planning and Modeling award of the Transportation Science and Logistics Society of INFORMS for the paper “A Simulation-based Optimization Framework for Urban Transportation Problems.” She co-authored the paper with Michel Bierlaire.

Georgia Perakis won the 2016 Best Paper Award Competition of the INFORMS Service Science Section. Her winning paper, co-authored with Lennart Baardman, Maxime C. Cohen, Kiran Panchamgam, and Danny Segev, was “Scheduling Promotion Vehicles to Boost Profits.” Perakis had two papers that were finalists for this Best Paper Award; the other, co-authored with MIT ORC PhD student Charles Thraves, was “On a Variation of Two-part Tariff Pricing of Services: A Data Driven Approach.”

Georgia Perakis has been selected to be an INFORMS Fellow, Class of 2016. This award honors “distinguished individuals who have demonstrated outstanding and exceptional accomplishments in operations research and the management sciences” and whose “service to the profession and to INFORMS is truly remarkable.” Perakis in particular was cited for “exceptional research, spanning theory to practice with important contributions to variational inequalities, the price of anarchy, dynamic pricing and data analytics, and for her dedicated mentorship of a future generation of OR scholars.” She was also named the Sloan School Teacher of the Year.

David Simchi-Levi, and his Phd Students, Yan Zhao and Xiao Fang received the 2017 SIAM Data Mining Best Research paper Award. Their winning paper is entitled “Uplift Modeling with Multiple Treatments and General Response Types.” The award was received in the SIAM Data Mining award ceremony on Friday April 28, 2017.

Caroline Uhler was named a 2017 Sloan Research Fellow. She also received an NSF Career Award for her paper “Gaussian Graphical Models: Theory, Computation, and Applications.”

Juan Pablo Vielma received the Presidential Early Career Award for Scientists and Engineers on January 9, 2017. He has been promoted to associate professor.

Y. Karen Zheng has been promoted to associate professor.

## **Students**

Ali Aouad was a finalist in the George Nicholson Student Paper Competition for his paper, “Greedy-Like Algorithms for Dynamic Assortment Optimization under Multinomial Logit Preferences,” co-authored with Retsef Levi and Danny Segev.

Eduardo Candela was selected as a member of the “Best National Engineering Graduates” Class of 2016, an honor granted by the Mexican Association of Engineering Schools and Faculties. The ceremony took place in Mexico City on June 9, 2017, during the XLIV National Engineering Conference.

Lennart Baardman, Maxime Cohen, and Georgia Perakis, along with Kiran Panchamgam and Danny Segev, received the 2016 INFORMS Revenue Management and Pricing Best Cluster Paper Award for the paper “Scheduling Promotion Vehicles to Boost Profits.”

Maxime Cohen won the 2016 INFORMS Revenue Management and Pricing Section Dissertation Award for his PhD thesis, “Pricing for Retail, Social Networks and Green Technologies.”

Chong Yang Goh and Chiwei Yan won the 2017 Hubway Data Challenge Best Data Exploration Tool Award, presented by Microsoft.

Swati Gupta was a finalists in the Best Student Paper Award of the INFORMS Service Science Section for her paper entitled “An Efficient Algorithm for Dynamic Pricing using a Graphical Representation,” co-authored by Maxime Cohen, Jeremy Kalas, Kiran Panchangam, and Georgia Perakis.

Swati Gupta, John Silberholz, and Iain Dunning received special recognition from the INFORMS Computing Society, as a part of the 2016 INFORMS Computing Society Student Paper Award, for the paper “What Works Best When? A Systematic Evaluation of Heuristics for Max-Cut and QUBO.”

Joey Huchette, Miles Lubin, and Iain Dunning were awarded the prestigious INFORMS Computing Society prize for the mathematical programming modeling language JuMP, 2016.

Will Ma received second place in the POMS-Hong Kong Chapter (Hong Kong University of Science and Technology) Best Student Paper Competition for the paper titled “Dynamic Recommendation at Checkout under Inventory Constraint.”

Christopher Marks received a 2016 Best Student Paper Award from the INFORMS Social Media Analytics section for the paper, “Finding Online Extremists in Social Networks.” This paper was co-authored by Professor Jytte Klausen and Professor Tauhid Zaman.

Brad Sturt was awarded the 2016–2017 Sloan Outstanding Teaching Assistant Award for his work as a teaching assistant in 15.060 Data, Models, and Decisions in fall 2016.

Rajan Udvani was a finalist in the INFORMS George Nicholson Student Paper Competition for his paper “Robust Monotone Submodular Function Maximization,” co-authored with James Orlin and Andreas Schulz.

## **Alumni**

Ilan Lobel was named to the 2017 “Best 40 Under 40 Professors” by Poets&Quants.

Garrett J. van Ryzin received the 2016 INFORMS Impact Prize for contributions in revenue management.

**Dimitris Bertsimas**  
**Co-director**  
**Boeing Professor of Operations Research**

**Patrick Jaillet**  
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**Dugald C. Jackson Professor of Electrical Engineering and Computer Science**