

Operations Research Center

The [Operations Research Center](#) (ORC), established in 1953 as a first-of-a-kind interdepartmental graduate degree program, completed its 62nd year of operation in 2014–2015. ORC administers its own graduate programs and a varied research program of methodological and applied projects. It maintains a reading room with a small library as well as state-of-the-art computational servers and a conference room equipped with distance education equipment.

This report summarizes ORC's AY2015 activities and briefly reviews its educational, research, and outreach programs.

Faculty, Students, and Staff

Professors Dimitris Bertsimas and Patrick Jaillet continue to serve as co-directors of the Operations Research Center.

During AY2015, ORC had 50 affiliated faculty and two staff members, with faculty 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 PhD degree and a master's degree. During the past year, these programs enrolled 84 students: 68 PhD candidates and 16 SM candidates. ORC conferred 10 master's degrees and 11 PhDs. Several other PhD theses were in the final stages of completion in summer 2015.

We had an outstanding year in terms of yield in admissions, receiving 274 applications for the doctoral program. We made 21 admission offers, and 15 were accepted. Two doctoral students deferred their admission for one year. In addition, we received 113 applications for the SM program; seven offers were made, and five were accepted. Three National Science Foundation (NSF) predoctoral fellows are enrolled at ORC in addition to one US Department of Energy fellow, one National Defense Science and Engineering Graduate fellow, and two Natural Sciences and Engineering Research Council of Canada fellows.

We continue to place our students exceptionally well in both academic and industrial jobs. For example, this year graduates accepted positions as assistant professors at Harvard, New York University, Cornell, and the University of California, Los Angeles.

Academic Programs

ORC's academic programs continue to be recognized as among the very best nationally and internationally. Moreover, the programs are repeatedly cited 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.

Methodological research includes such topics as linear, nonlinear, and combinatorial optimization; solution methods for integer programming; interior point methods for linear and nonlinear programming; dynamic programming; cluster analysis; parallel and distributed computation and algorithms; network flow algorithms; network design; probabilistic combinatorial optimization; online optimization; deterministic and stochastic facility location; queuing theory, including queuing networks; risk analysis; stochastic processes; classical and Bayesian statistics; game theory; and decision analysis and statistical decision theory.

ORC faculty members contribute to application domains as wide ranging as manufacturing, communications, transportation, public services, logistics, marketing, financial services, health care, and nuclear engineering. Current projects are addressing such topics as air traffic control; epidemiology; cancer treatment; life-cycle modeling of municipal solid waste; safety, risk analysis, and network design in air transportation; telecommunication network design; supply chain management; production scheduling; and transportation logistics, diseases, and disasters.

Several organizations sponsored research projects at ORC during AY2015, including NSF, Draper Laboratory (Draper fellowships), General Motors, Lincoln Laboratory, the Air Force Office of Scientific Research, and the Singapore-MIT Alliance for Research and Technology.

Outreach and Professional Service

During AY2015, ORC held multiple faculty meetings to discuss issues of importance to the center. Topics included the possible creation of a new entity at MIT and the implications for ORC, ORC's strategy regarding the field of analytics and the possibility of an analytics master's program, and extensive renovations to the center's physical space.

The ORC Weekly Seminar Series was privileged to have many distinguished speakers from industry and academia this year. The operations research professionals who made presentations included Retsef Levi (MIT), Peng Shi (MIT), Andy Philpott (University of Auckland), Michael I. Jordan (University of California, Berkeley), Aurelie Thiele (Lehigh University), Peter Frazier (Cornell University), Garrett van Ryzin (Columbia Business School), Donald Goldfarb (Columbia University), Erick Delage (HEC Montréal), Fatma Kılınc-Karzan (Carnegie Mellon University), Georgia Perakis (MIT), Aharon Ben-Tal (Technion), Drazen Prelec (MIT), Mor Armony (New York University); Joseph Doyle (MIT), Beril Toktay (Georgia Institute of Technology), Jim Renegar (Cornell University), Robert Krauthgamer (Weizmann Institute of Science), Jan Van Mieghem (Northwestern University), Margaret Brandeau (Stanford University), Bill Cook (University of Waterloo), Ramesh Johari (Stanford University), and Asuman Ozdaglar (MIT).

During the January Independent Activities Period, ORC offered a full-day session titled “Social Networks in Operations Research” in which several talks explored how data from these networks can be used to make decisions or to understand social phenomena. Speakers included Jiwoong Shin (Yale University), Natasha Markuzon (Draper Laboratory), and Tauhid Zaman (MIT).

Student-Run Programs and Activities

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

- INFORMS Ice Cream Social: a stress relief opportunity for students taking the qualifying exam
- INFORMS “Back to School” pizza party: an event allowing guests to reconnect with continuing students and meet new students at ORC
- INFORMS October Barbeque: a social event for ORC students wrapping up student retreat activities
- ORC reunion at the INFORMS conference: an informal “reunion” event in San Francisco that allowed current students to touch base with ORC alums
- Crepes Social Event: an activity hosted by INFORMS officers, with food provided by one of our French students
- Social Fridays: gatherings encouraging all ORC students to get together on Friday afternoons

ORC is also proud of the work done by our student REFS (Resources for Easing Friction and Stress) volunteers. This program is run by students who complete training in conflict resolution and are familiar with other resources offered at MIT. They make themselves available as moderators for conflicts and as confidants for students who may be experiencing difficulties. We feel this is an invaluable resource to our students. The student volunteers also organize events centered on reducing stress and tension, including social events designed to increase awareness of the REFS program and allow discussion of student issues and concerns.

The ORC students continue to maintain informational websites on Statistics and Optimization as a reference point for other students on courses, research, and related resources that are available to them. There are plans underway for similar sites to be developed covering both Analytics and Applied Probability.

Future Plans

The ORC program has been expanding. The center has increased its total number of students, and a new master’s degree program in analytics is being prepared. ORC is also undergoing significant physical changes, with renovations scheduled to be completed in November 2015.

At the same time, the Institute has announced the formation of the Institute for Data, Systems, and Society, which intersects with ORC's offerings and activities.

The newly introduced PhD track/specialization in analytics has been successful thus far and joins the previously added operations management and networked systems tracks. ORC will continue work toward the establishment of the proposed enhanced and larger SM program in decision analytics.

In terms of renovations, ORC is in the midst of a major redesign of its physical space, which will be opened up to maximize the available desk space for our growing student population. We have put an emphasis on an open floor plan, shared desk space, and multiple meeting rooms to facilitate collaboration. We believe that this redesign, essential as plans for the new, larger SM program move forward, will greatly improve the learning environment for our current and future students while being able to accommodate many more students comfortably.

ORC intends to play a larger role in decision analytics and statistics within the Institute. It is our hope to be an academic leader in this growing field moving forward.

Diversity

ORC has always attempted to provide an environment that is responsive to the varied professional and personal needs of MIT's operations research community and that builds diversity. Of the center's two staff members (a support staff person and an academic administrator), one is a woman. Sixteen of our current graduate students are women.

Over the past several years, we have made efforts to attract qualified women and underrepresented minorities to our graduate programs by targeting information to math departments in liberal arts colleges and by sending information to historically black colleges.

Administrative Changes

In AY2015, ORC's reporting and administrative structure changed from previous years. Instead of reporting directly to the vice president for research, ORC now reports jointly to the dean of the Sloan School of Management and the dean of the School of Engineering.

Effective January 1, 2015, ORC administrative/financial reporting transitioned to the Sloan School of Management. The center will remain programmatically joint between the School of Engineering and the Sloan School.

Professional Activities

Faculty

Itai Ashlagi won second place in the 2014 INFORMS Junior Faculty Interest Group paper competition. Itai's paper, co-authored with Yash Kanoria and Jacob Leshno (both of the

Columbia Business School), was titled “Unbalanced Random Matching Markets: The Stark Effect of Competition.”

Hamsa Balakrishnan received the 2014 Donald P. Eckman Award from the American Automatic Control Council (AACC). The Eckman Award recognizes outstanding engineers in the field of automatic control under the age of 35.

Cynthia Barnhart was awarded an honorary PhD from the École Polytechnique Fédérale de Lausanne.

Dimitri Bertsekas received the 2014 AACC Richard E. Bellman Control Heritage Award, which recognizes contributions to the foundations of deterministic and stochastic optimization-based methods in systems and control. Dimitri also received the 2014 Khachiyan Prize, awarded for lifetime accomplishments in optimization, and the 2015 Mathematical Optimization Society/Society for Industrial and Applied Mathematics George B. Dantzig Prize.

Erik Brynjolfsson and his co-authors (Frank MacCrory and George Westerman from the MIT Initiative on the Digital Economy and Yousef Alhammedi from the Masdar Institute in Abu Dhabi) won the 2014 International Conference on Information Systems Award for Best Conference Paper. Their winning paper was titled “Racing With and Against the Machine: Changes in Occupational Skill Composition in an Era of Rapid Technological Advance.”

Vivek Farias won the 2014 INFORMS Simulation Society Outstanding Simulation Publication Award, which recognizes outstanding contributions to the simulation literature. Vivek’s winning paper (co-authored with Vijay Desai and Ciamac Moallemi, both of Columbia University) was titled “Pathwise Optimization for Optimal Stopping Problems.”

Andrew Lo and Peter Alexander Lee received the Harry M. Markowitz Award runner-up prize for the paper “Hedge Fund Beta Replication: A Five Year Retrospective.”

Georgia Perakis won the Best Application of Theory Award at the 2015 Northeast Decision Sciences Institute Conference. Her winning paper, co-authored with Maxime C. Cohen (ORC), Ngai-Hang Zachary Leung (Carnegie Mellon University), and Kiran Panchamgam and Anthony Smith (both of Oracle), was titled “Promotion Planning Through an Optimization Lens: From Theory to Practice.”

David Simchi-Levi, Kristine Johnson, and Alex Lee received the 2014 INFORMS Revenue Management and Pricing Section Practice Award for their project “Analytics for an Online Retailer—Demand Forecasting and Price Optimization at Rue La La.”

David Simchi-Levi, Yehua Wei, and Peter Yun Zhang received the 2014 INFORMS Daniel H. Wagner Prize for Excellence in Operations Research Practice for the paper “Identifying Risks and Mitigating Disruptions in the Automotive Supply Chain” and the Ford 2015 Engineering Excellence Award for “Identifying Risks and Mitigating Disruptions in the Ford Supply Chain.”

Y. Karen Zheng received an NSF CAREER Award for her project “A Closed-Loop Methodology for Investigating Trust, Culture, and Information Sharing in Global Supply Chains.” CAREER Awards are NSF’s most prestigious awards in support of junior faculty who exemplify the role of teacher-scholars through outstanding research, excellent education, and the integration of education and research within the context of the mission of their organizations.

Students

Michael Beeler was awarded a D-Prize for a social enterprise business plan drawing on analytics and operations management principles to deliver quality secondary education in rural areas of developing countries.

Yaron Shaposhnik was a finalist in the 2014 INFORMS Manufacturing and Service Operations Management Society Student Paper Competition for “Scheduling with Testing.” This award is given annually for papers judged to be the best in the field of operations management.

Alumni

Edward H. Kaplan has been elected to lead the Institute for Operations Research and the Management Sciences. With more than 11,500 members, INFORMS is the largest association of operations research and analytics professionals in the world. Kaplan will serve terms as president-elect in 2015, president in 2016, and past president in 2017.

Dimitris Bertsimas

Co-Director

Boeing Professor of Operations Research

Patrick Jaillet

Co-Director

Dugald C. Jackson Professor of Electrical Engineering and Computer Science