

Operations Research Center

The Operations Research Center (ORC), established in 1953 as a first-of-a-kind interdepartmental graduate degree program, completed its 56th year of operation in 2008–2009. The 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 workstations and a conference room outfitted with distance-education equipment.

This report summarizes AY2009 activities and briefly reviews its educational, research, and outreach programs.

Faculty, Students, Staff

During AY2009, professors Cynthia Barnhart and Dimitris Bertsimas served as codirectors of the ORC.

This year, ORC had 48 affiliated faculty and senior staff, 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 and a master's degree. During the past year, these programs enrolled 54 students—44 PhD candidates and 10 SM candidates. ORC conferred five master's degrees and eight PhDs. Several other PhD theses were in the final stages of completion in summer 2009.

Academic Programs

ORC's academic programs continue to be recognized as ranking 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, 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 topics such 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; 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 are also contributing to application domains as wide ranging as manufacturing, communications, transportation, public services, logistics, marketing, financial services, health care, and nuclear engineering. Current projects address topics such as air traffic control; epidemiology; AIDS testing; 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 the ORC during 2008–2009, including the National Science Foundation Draper Laboratory, General Motors, Lincoln Laboratory, Air Force Office of Scientific Research, Office of Naval Research, and the Singapore–MIT Alliance Program.

Outreach and Professional Service

During the past year, the ORC implemented a number of initiatives that had previously been identified as future goals for the center. During the year we formed two committees. The purpose of the first committee is to investigate the restructuring of requirements for the doctoral program with the objective of improving the placement of our graduates in academic jobs. The second committee will investigate the restructuring of our master's program with the objective of offering a new, enhanced, and larger program that would have a greater impact in the community at large.

Ensuring the continued ability to support graduate students: ORC increased its efforts to submit research proposals to obtain significant-sized, collaborative research grants. One example is the SMART project proposal on future urban mobility. Eight ORC–affiliated faculty are participating as principal investigators with one serving as project director and another as codirector.

Seminar Series: 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 Nikhil Bansal (IBM Watson), Shane Henderson (Cornell University), John Hooker (Carnegie Mellon University), Noah Gans (University of Pennsylvania), Jiawei Zheng (New York University), Georgia Perakis (MIT), Edward Kaplan (Yale University), Kavita Ramanan (Carnegie Mellon University), Hans-Jakob Luethi (ETH [Swiss Federal Institute of Technology]), Jorge Nocedal (Northwestern University), Jesus De Loera (University of California, Davis), Ravindra Ahuja (University of Florida), Brenda Dietrich (IBM Watson), Achal Bassamboo (Northwestern University), Shmuel Oren (University of California, Berkeley), Guillermo Gallego (Columbia University), Thomas Magnanti (MIT), Paul Zipkin (Duke University), Jonathan Caulkins (Carnegie Mellon University), Levent Tuncel (University of Waterloo), and Christian Borgs (Microsoft).

ORC also offered, during January Independent Activities Period, a full-day session entitled “Quantitative Methods in the Real World” in which several talks focused on the application of analytical techniques (optimization, stochastic processes, statistics) to real-world problems. The speakers included Benoit Couet (Schlumberger-Doll Research), Michael Prange (Schlumberger-Doll Research), Vishal Gupta (Barclays Capital),

Alan King (IBM Watson Research Center), and Bala Chandran (Analytics Operations Engineering).

Future Plans

The ORC program is stable and does not face any unusual challenges. In AY2010 we plan to implement the recommendations of the PhD committee and also explore the offering of the new enhanced master's program for AY2011.

Diversity

ORC has always attempted to provide an environment that is responsive to the varied professional and personal needs of the operations research community at MIT, and that builds diversity.

The staff of ORC is composed of two support staff members and one administrative officer. Of these three staff, two are women, and one is African American. Ten of our current graduate students are women and one doctoral student is an underrepresented minority.

Over the past 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.

Professional Activities

ORC Faculty

Dimitris Bertsimas received the Farkas Prize in October 2008. The Farkas Prize is awarded for the most significant contribution to the field of optimization by a researcher or team of researchers.

Richard de Neufville received the Francis X. McKelvey Award from the Transportation Research Board for contributions to airports and aviation.

Jeremie Gallien was nominated Edelman Laureate earlier this year after being selected as a finalist in the 2009 Franz Edelman Competition of INFORMS for his team's entry "Zara Uses Operations Research to Reengineer Its Global Distribution Process."

Michel Goemans became an ACM Fellow.

Richard Larson was invited to serve on two public forums: the Institute of Medicine Standing Committee on Medical Readiness and the Massachusetts Department of Elementary and Secondary Education Review Panel for the Science and Technology/Engineering Curriculum Framework of K-12 Education.

Retsef Levi was awarded the Optimization Prize for Young Researchers. This prize is given to one (or more) young researchers for the most outstanding paper in optimization

that is submitted to or published in a refereed professional journal (paper coauthored with Ganesh Janakiraman and Mahesh Nagarajan, “A 2-Approximation Algorithm for Stochastic Inventory Control Models with Lost Sales”).

James Orlin was a cowinner of the INFORMS 2008 Koopman Prize (named after Bernard Koopman) awarded by the Military Application Society for an outstanding publication in military operations research. The award was for the paper “Exact and Heuristic Algorithms for the Weapon-Target Assignment Problem” jointly written with Ravi Ahuja, Arvind Kumar, and Krishna Jha, October 2008.

Andreas S. Schulz, his former student Nicolas E. Stier Moses, and their coauthors received the 2008 Best Paper Award of the Transportation Science & Logistics Society of INFORMS for “System-Optimal Routing of Traffic Flows with User Constraints in Networks with Congestion” (*Operations Research* 53 (2005), 600–616). This award is given every year to an outstanding paper in the field of transportation science and logistics. The paper must have been published in a refereed journal and must present innovative approaches for solving complex problems in transportation and/or logistics, with an emphasis on operations research and quantitative methods.

Devavrat Shah received the 2008 ACM Sigmetrics/Performance Rising Star. In addition, Shah and his student, Srikanth Jagabathula, received the 2008 NIPS Best Student Paper Award.

Yossi Sheffi was awarded the Eccles Medal. This award recognizes outstanding achievements in the development of logistics education. In addition, Professor Sheffi accepted the Aragón International Prize award on behalf of MIT for his instrumental role in the development of the Zaragoza Logistics Center. This award is one of the most prestigious awards granted annually by the government of Aragón in Spain and was created to recognize ongoing efforts in culture, science, technology, or human values that provide significant benefit for the community or a noteworthy example for the Aragónese society.

John Tsitsiklis received a Doctor honoris causa from the Université Catholique de Louvain (Belgium), October 2008.

ORC Students

Doug Fearing, an ORC doctoral candidate, received the UPS PhD Fellowship for AY2010. Doug was also honored for his excellent teaching skills with the Graduate Student Council Teaching Award (May 2009) and the Sloan Outstanding TA Award (May 2009).

Dmitriy Katz-Rogozhnikov and Tri-Dung Nguyen were finalists in the INFORMS George Nicholson Student Paper Competition, October 2008.

ORC Alumni

Margaret Brandeau was awarded the INFORMS President’s Award. The purpose of this award is to recognize, and thereby encourage, important contributions to the welfare of society by members of our profession at the local, national, or global level.

S. Raghavan and R. Day received the INFORMS Computing Society Prize for their paper “Fair Payments for Efficient Allocations in Public Sector Combinatorial Auctions.” This award is for the best English language paper or group of related papers on the OR/CS interface.

Sean P. Willems and John J. Neale received the Wagner Prize for Excellence in Operations Research Practice for their paper “Managing Inventory in Supply Chains with Non-Stationary Demand.” This prize emphasizes the quality and coherence of the analysis used in practice. Dr. Wagner strove for strong mathematics applied to practical problems, supported by clear and intelligible writing. This prize recognizes those principles by emphasizing good writing, strong analytical content, and verifiable practice successes.

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More information about the Operations Research Center can be found at <http://web.mit.edu/orc/www/>.