Practitioners of operations research apply scientific methods to complex systems in order to design and operate them efficiently and effectively; across institutions and organizations their work may be called by one of several closely related names, e.g., industrial engineering, systems engineering, management science, engineering management. Cornell’s Ph.D. program in Operations Research is intellectually rigorous, demanding independent investigation and achievement and characterized by original scholarly work of the highest caliber. The emphasis in the Ph.D. program is on operations research as a mathematical science. This provides our doctoral students with a strong analytical foundation for advanced research in the theory and methodology of Operations Research and in the development of new approaches to applications, aimed at enhancing the practice of operations research through novel and fundamental methodological innovations and applications of them.

Operations Research Learning Goals

Ph.D. candidates in Operations Research are expected to achieve the following.

LG1) Master the core tools of operations research and the mathematical foundations on which they rest.
LG2) Demonstrate computational proficiency.
LG3) Develop expertise in one of three areas of concentration -- applied probability and statistics, manufacturing systems engineering, or mathematical programming (optimization) -- and depth in two minor subjects in engineering, science (including mathematics), or technical areas of business (e.g., finance).
LG4) Develop and demonstrate advanced research skills, including ability to identify research opportunities, synthesize and extend existing knowledge, and communicate effectively in both written and oral exposition.
LG5) Make an original and significant contribution to the discipline.

Methods and Opportunities for Achieving Learning Goals

LG1) By the end of the third semester candidates should have demonstrated mastery of the material in the courses: ORIE 6300, ORIE 6500, ORIE 6700, Mathematics 4130, Mathematics 4330. By the end of the 6th semester candidates should have demonstrated mastery of the material in at least three additional advanced-level Ph.D. courses with at least one course from three of the following four areas: manufacturing and simulation, mathematical programming, probability, statistics.
LG2) Candidates should satisfy goal (LG2) through either a faculty-directed project or a computationally intensive course approved by the DGS, no later than the end of the sixth semester, preferably by the end of the fourth semester.
LG3) Candidates must form a committee no later than the fourth semester. The committee chair will require both advanced courses and readings in the major area, to be completed successfully prior to the A-exam, which should usually be taken before the
start of the seventh semester. The members of the committee representing the minor subjects will require appropriate courses in those areas to be completed prior to the A-exam. The A-exam may include questions from the committee to assess a candidate’s expertise in the major area and depth in the minor areas.

LG4) In the third semester candidates will study a research paper selected from a list submitted by OR Field members, and give an oral presentation of the paper. Some candidates may become involved in faculty-supervised reading courses and/or research projects prior to the Q-exam; for most candidates, faculty-supervised reading courses and/or research projects start between the end of the second semester and the beginning of the fifth semester. Usually, candidates will be required to develop a research proposal prior to the A-exam, and, often, candidates will have some publishable results by then; the A-exam will include a presentation of the proposal and results, and responses to questions by the committee.

LG5) Achievement of goal (LG5) is a process that begins with a candidate’s first research success and builds substantially toward the defense and completion of the Ph.D. thesis. Most candidates will have already presented papers at conferences and other universities and many will have had papers accepted for publication before the B-exam, the thesis defense.

Assessment of Learning Goals

Every academic year, the DGS will prepare a preliminary report on the performance and progress of each PhD student based on: grades, examination outcomes, a report to the DGS from the student’s committee chair, reports to the DGS by any faculty (other than the committee chair) supervising the student in research projects or reading courses, TA evaluations by supervising course instructors and the students in the courses, and a student self-assessment. The preliminary report will include information on research presentations and papers written/submitted/published. The Field of OR faculty will meet to discuss each student’s performance and progress with the preliminary report as a starting point. The DGS or committee chair will provide written feedback to the student based on this discussion; this will become part of the student’s file, maintained by the GFA. The discussions of individual student progress and performance will also be a starting point for the compilation of data for program assessment. After the faculty discussions of the preliminary reports, committee chairs, in collaboration with the DGS and GFA, will complete a brief annual report on each PhD student. These will not include student names. They will be collected into groups based on the number of years completed in the PhD program.

Annually, the Field of OR faculty will assess the degree to which the learning goals are being met and consider appropriate programmatic actions to address perceived shortcomings and/or opportunities for improvement. The DGS will present to the faculty a preliminary summary of overall student achievement distilled from the annual reports on individual student achievement. Goals (LG1) and (LG3) will be assessed every year, (LG4) and (LG5), alternately, every second year, and (LG2) every third year.
Goal    Assessment Mechanisms

LG1)    Q-exams, final examinations and grades in ORIE courses, grades and faculty
         assessments in Math courses, self-assessments, annual reports.
LG2)    Project reports, instructor/project supervisor evaluations.
LG3)    A-exams, course grades, self-assessments, annual reports.
LG4)    Q-paper presentations, A-exams, self-assessments, research presentations, TA
         evaluations by students and instructors, GRA/project evaluations by supervisors, annual
         reports.
LG5)    B-exams, research presentations, research papers, self-assessments, annual
         reports.