

Operations Management PhD Program  
Guidelines and Requirements

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## Overview

The Doctoral Program at the Kellogg School of Management trains students to be innovative researchers with careers as professors. In preparation for the demands of academia, all doctoral students must meet a set of coursework requirements, pass a written qualifying examination and an oral examination (proposal), and complete a dissertation. Students must satisfy additional requirements, such as annual research presentations, teaching and research assistance, and other requirements determined by each program. C.f. the general program requirements of [Kellogg](#) and [The Graduate School](#).

This document specifies the specific Program Guidelines and Requirements for the Operations Management (OM) PhD program offered by the Operations department of the Kellogg School of Management at Northwestern University.

If there are any questions regarding this document, or aspects of the program not covered in this document, please contact the PhD Program Director.

These guidelines are organized by year in the program. In addition, there is a brief section at the end discussing the dismissal from the program.

Note that these Program Guidelines are subject to change.

# 1 Requirements and Guidelines for First-Year Students

## 1.1 Coursework

First-year PhD students are required to take the following courses in the first year. This corresponds to a load of three to four courses each term (Fall, Winter, Spring). Students may audit other courses with the permission of the instructor, but typically are not permitted to enroll in more than for courses in one term.

The courses listed below are the standard, required courses in the first-year curriculum. When appropriate, a student may petition the PhD Program Director to be granted a waiver for one or more of these course requirements because the student has already mastered the relevant content. Evidence of this mastery—e.g., good performance on a relevant examination—is necessary for a waiver to be considered.

- 1) Pre-term (3 weeks before start of Fall quarter): Math Camp (ECON 401) and Econometrics Camp. Do the pre-readings before coming to campus. Based on ECON 401 exam performance, a later course in real analysis may be required.
- 2) Fall
  - a) OPNS 521 Foundations of Operations Management
  - b) OPNS 430/440 Operations Management (MBA core, see below)
  - c) MECS 560-1 Static Optimization in Economics (or equivalent in IEMS)
  - d) ECON 410-1 Microeconomics
- 3) Winter
  - a) IEMS 460-1 Stochastic Models I
  - b) MECS 560-2 Dynamic Optimization in Economics (or equivalent in IEMS)
  - c) ECON 480-2 Introduction to Econometrics
- 4) Spring
  - a) OPNS 516 Stochastic Foundations
  - b) OPNS 525 Emerging Areas in Operations Management
  - c) ECON 410-3 Microeconomics
  - d) ECON 480-3 Introduction to Econometrics

The core operations MBA class (OPNS430 or OPNS440) gives an excellent broad overview of OM and exposes you to a managerial perspective and to MBA teaching. PhD students can form one group for homework assignments. To register an MBA class, ask the Doctoral Program early (before MBA enrollments start); second best is to register as Independent Study (but then the course will not show up on your transcript) and you report the course-grade from the instructor to the PhD Program Director.

## 1.2 First-Year Qualifying Examination

A written qualifying examination in the major field is required. This exam is focused on the coursework taken in the student's major field of study and measures the student's knowledge of the field as a whole. This examination is conducted in two parts, at the end of the first and second year respectively.

In order to continue to the second year of study, a student is required to **demonstrate proficiency** in

1. Operations Management,
2. Optimization,
3. Microeconomics, and
4. Econometrics.

Proficiency in these four areas will be tested during a written Qualifying Examination during two consecutive days and administered by the faculty of the operations department (typically offered end of June). Students also must [maintain a 3.0 GPA](#). The faculty of the Operations department will deliberate and the PhD Director will inform the students of their performance early July.

Students who do not pass the Qualifying Exam and do not maintain a 3.0GPA on the required coursework may face [academic probation](#) and/or risk [exclusion](#) from the PhD Program.

## 1.3 Operations Seminars

The students are **required** to attend the weekly Operations seminars. If there is a potential conflict with their class schedule, they should see the program Director. They are also encouraged to attend the related seminars in Kellogg, IEMS, and elsewhere in Northwestern.

## 1.4 Research and Teaching Assistantships

First-year students are not expected to fulfill a research or teaching assistantship requirement, but students who feel comfortable with their first-year coursework are welcome to seek them out.

## 1.5 Summer Research Activity and Residency Requirements

Students who pass their exams at the end of the first year are expected to spend the summer working with, or under the supervision of, one or more faculty members to pursue research and/or directed reading. If students cannot find a faculty member to work with on their own, they should see the PhD Program Director early in the Spring quarter.

Doctoral students are expected to be on campus full time and involved in the research and teaching activities of the department throughout the year, including summer quarter, to qualify for continued funding. **Students who will be away from campus for more than three (3) weeks during an academic quarter need the approval of their PhD Director and dissertation advisor, if students have a dissertation advisor at this point in their studies.** Unexcused absences may disqualify students from receiving financial aid from the Kellogg School of Management and/or Northwestern University.

## 1.6 Activity Report and Milestone Tracking on GSTS

All PhD students are required to submit an annual activity report, including summer activity, and keep their record current on the [Graduate Student Tracking System GSTS](#). The activity report is considered as part of qualifying for next-year funding.

## 1.7 Progress Guidelines

First-year students' progress is measured by their course grades and their performance on the prelim exams. Students must maintain at least a B average and satisfy the Qualifying Examination requirements discussed in Section 1.2 to be in good academic standing. Students who are not in good academic standing should meet regularly with the PhD Program Director to ensure that they return to good standing as soon as possible. A student who is not in good academic standing at the end of the first year should expect to lose financial support and should expect to be asked to leave the program. Even though some research activity is expected in the summer after the first year, there is no direct evaluation of a student's research output in the first year.

During their first year, the PhD Program Director will meet students if at anytime their progress is not satisfactory.

Students will receive periodic written progress evaluations from the faculty and the PhD Program Director via GSTS.

## 1.8 Requirements for a Master's Degree

While the goal of our doctoral program is the awarding of a PhD degree, in certain circumstances a master of science (MS) degree may be awarded to qualified doctoral students.

Students who are continuing for a PhD degree may be considered for a MS degree if they are in good standing, they have completed a minimum of three quarters of coursework, they have no incomplete grades, they have maintained an overall "B" average, and they will not receive residency (transfer) credit toward their PhD coursework requirements from a previously earned graduate degree. Students who are awarded residency credit are made ineligible for a MS degree from Northwestern as stipulated in regulations of the Graduate School.

Students who are leaving the doctoral program without completing the PhD will be considered for the MS degree if they have completed a minimum of three quarters of coursework, they have no incomplete grades, and they have maintained an overall "B" average.

## 2 Requirements and Guidelines for Second-year Students

### 2.1 Coursework

Required coursework during the second year includes a fairly flexible arrangement to induce gradual transition from coursework to independent research. A total of 12 courses comprised of:

1. Every OPNS doctoral courses offered that year (and audit the OPNS 525 Emerging Areas in Operations Management course when taught by different instructor). These advanced courses are typically offered one course per quarter. Examples: OPNS522 Queuing Networks; OPNS523 Empirical Dynamic Models in Operations Management; OPNS 463 Stochastic Calculus & Control, and seminar courses such as OPNS-481 Revenue Optimization.
1. Two breadth elective courses to gain familiarity with the basics of related management fields. These can be MBA core or PhD foundational courses taught by faculty members of the Accounting, Marketing, MORS, Finance, or Strategy departments.
2. One or more independent study courses (OPNS 499) to start the summer paper requirement (see later).
3. Desired depth courses (or Operations MBA electives), which can be chosen throughout the university (subject to PhD Program Director approval).

Kellogg PhD courses in other fields including but not limited to:

MECS 560-3 Foundations of Managerial Economics III: Game Theory  
MECS 565 Contract Theory and Mechanism Design,  
MECS 568 Topics in Economic Theory,  
MECS 599-1 Competitive Strategy,  
MECS 549-2 Strategy and Organizational Structure,  
FINC 586 Corporate Finance  
FINC 587 Dynamic Asset Pricing Theory  
FINC 588 Econometrics of Financial Markets  
FINC 589 Empirical Corporate Finance  
ACCT 520-3 Seminar in Information Economics and Analytical Accounting Research  
ACCT 520-4 Seminar on Agency Theory and Information Economics  
MKTG 520-7 Seminar in Marketing  
MKTG 551: Mktg Models: Quant Modeling

Economics PhD courses such as:

ECON 450- 1,2,3 Industrial Organization,  
Econ 414-1,2,3 Economics of Information,  
ECON 412-1,2,3 Economic Theory and Methods  
ECON 480- 1,2,3 Introduction to Econometrics

PhD Courses in IEMS, EECS, Mathematics, Statistics including but not limited to:

IEMS 464 Advanced Queueing Theory  
IEMS 465 Simulation Experiment Design and Analysis  
IEMS 484 Inventory and Distribution Systems  
IEMS 490 Special Topics: Dynamic Programming  
IEMS 490 Health Policy Modeling  
EECS 479/IEMS 450 Nonlinear Optimization  
EECS 510 Probabilistic Techniques in Communication and Computation  
MATH 410- 1,2,3 Analysis  
MATH 450 -1,2,3 Probability  
MATH 455 -1,2,3 Stochastic Analysis  
STAT 454 – Time Series Analysis  
STAT301: Data science  
EECS 435: Neural Networks  
EECS 495: Special Topics in EECS

## 2.2 Seminars

All PhD students are required to attend the weekly operations seminars. They are encouraged to attend seminars (relating to OM) elsewhere on campus.

## 2.3 Research & Teaching Assistantships

To become better integrated into the department's intellectual life, in years two, three, and four, a portion of the student's stipend is allocated toward wages for teaching and research assistance for approximately 10 hours per week. These appointments are like apprenticeships; students receive on-the-job training under the guidance of the faculty.

Research assistantships (RA) are an excellent lead-in to research; Teaching assistantships (TA) prepare you for teaching *and* will provide you with a course that you “can take with you and teach after you graduate.” (The value of the latter can hardly be underestimated as any seasoned faculty member will tell you: it is a very worthwhile investment now even though you will only get its rewards after obtaining the PhD.)

Second to fourth year students should be involved in research and teaching assistantships at a recommended average level of 10 hours per week *throughout the academic year of 4 quarters* aiming for a mix of roughly half RA, half TA. A regular TA assignment is two sections of one MBA course, supplemented if needed with exam-only-grading. Additional grading would be for additional pay (“ad-pay”). It is fine to work more hours some quarters and less during others, as positions related to teaching and grading will often demand this. Students who have advisors typically are TAs for their advisor. We will coordinate equitable (workload balanced) TA-assignments in Fall quarter, but it's a good idea that second years divide the core and elective MBA courses among them so there is continual rotation and senior PhD students can coach junior students.

This work requirement is formally a condition of the fellowship support. The work requirements for students who do not receive fellowship support from Northwestern will be specified in writing by the PhD Program Directors at the time of admission, or when the funding is acquired if it is after the admission decision.

## 2.4 Second Year Qualifying Examination and Candidacy:

To encourage and demonstrate the transition from coursework to research, students are required during the second year to write a research paper and pass a Qualifying Examination of that research paper. Specifically:

- Before the end of Spring quarter of the second year (ideally this is done much earlier), students must form their “summer paper committee” of at least three Operations faculty. The summer paper committee is chaired by the supervising faculty member (who could, but does not need to, become the later dissertation committee chair).
- Before the end of the summer quarter of their second year, students must submit via GSTS their summer paper to their summer paper committee and to the PhD Director.
- During the first week of Fall quarter of the third year, students must present their paper to their summer paper committee and be prepared to answer any examining questions by the committee.

Upon successful passing of these summer paper requirements and receiving written approval by the summer paper committee chair and maintaining a 3.0GPA in coursework, the student is admitted to Candidacy.

Students who do not meet predetermined deadlines and degree requirements may face academic probation and/or risk exclusion from the PhD Program.

## 2.5 Summer Research Activity

Students are expected to be involved in research in their second summer to write their summer paper. If students are not working on their own, under the guidance of a faculty member, and are having trouble connecting with a faculty member on their own, they should see the PhD Program Director early in the Spring quarter.

Doctoral students are expected to be on campus full time and involved in the research and teaching activities of the department throughout the year, including summer quarter, to qualify for continued funding. **Students who will be away from campus for more than three (3) weeks during an academic quarter need the approval of their PhD Director and dissertation advisor, if students have a dissertation advisor at this point in their studies.** Unexcused absences may disqualify students from receiving financial aid from the Kellogg School of Management and/or Northwestern University.

## **2.6 Activity Report and Milestone Tracking on GSTS**

All PhD students are required to submit an annual activity report, including summer activity, and keep their record current on the [Graduate Student Tracking System GSTS](#). The activity report is considered as part of qualifying for next-year funding.

## **2.7 Progress Guidelines**

Second-year students' progress is measured by their course grades, their research (specifically, their second-year papers), and their integration into the research and teaching environment through seminar attendance and RA/TA work. Students must maintain at least a B average, complete the second-year paper before the start of the 3rd year, and fulfill their field course and seminar attendance requirements to be in good standing. Students who are not in good standing at any point must meet regularly with the PhD Program Director to ensure that they return to good standing as soon as possible. A student who is not in good academic standing at the end of the second year should expect to lose financial support and should expect to be asked to leave the program.

Students will receive periodic written progress evaluations from the faculty and the PhD Program Director via GSTS.

## **2.8 Elective MBA Operations Courses**

Students are strongly encouraged to get familiar with at least one MBA OPNS elective to increase their exposure to MBA curriculum and teaching. (Register before MBA enrollment via the Doctoral Office, or as independent study.) TAing a course is a good way to do this. Such opportunities are available on a regular basis. Please see the program Director (or other faculty in OPNS group) if you are looking for such opportunities.

### 3 Requirements and Guidelines for Students in the third-year and above

Students in their third year and higher are trained to become independent researchers. (Those who like, can still take PhD or MBA courses through year 5 upon permission of the DGS.) This process culminates in the Doctoral Dissertation, which should demonstrate “mastery.” Doctoral candidates should think in terms of their *personal brand* to convey their mastery, which can be in a topic (“retail expert” who could use the appropriate research method for the problem at hand) or a methodology (“stochastic control or empirical expert” who could apply that methodology in possibly distinct topics). The principal advisor typically aligns with the expertise sought and additional faculty advisors help with breadth or depth.

#### 3.1a Dissertation Committee

Students in their third year must choose a dissertation advisor, form a Dissertation Proposal Committee and formulate and defend a dissertation proposal. Students should notify the PhD Program Director in writing when they form their Dissertation Proposal Committee.

Dissertation committees are reviewed and approved by the senior associate dean for faculty and research at the time of the proposal and final examination (dissertation defense). The committee consists of at least four tenure-track/research faculty members, at least three of whom are on the Kellogg faculty. At least one member of the committee must be outside the student's program. The committee chair and at least one other member must be from The Graduate School faculty, and the chair and at least one other committee member are expected to hold appointments in the student's program to ensure that half of the committee members represent the student's program. Usually one member of the committee represents the student's minor field of study.

The dissertation committee chair and at least one other dissertation committee member must be faculty members of the Operations department.

These are the criteria for choosing a committee member from outside the student's department/program:

1. a faculty member from outside the department/program or outside of the Kellogg School, but within Northwestern University;
2. a faculty member from outside Northwestern who has a permanent appointment (tenure-track, a research professor) at another university and who supervises doctoral students as they complete their dissertations.

Please note that a faculty member with a joint appointment spanning two Kellogg departments, one of which is within the student's own program, cannot be used as someone from outside the student's program.

The dissertation committee chair and at least one other dissertation committee member must be faculty members of the Operations department.

#### 3.1b Dissertation Proposal

After completing the coursework and the written qualifying examination, a student takes an oral examination in which he or she proposes a dissertation topic or other substantive piece of

research, discusses its significance, and explains the research methods to be used and any preliminary results of the paper(s).

Students must form their dissertation committee and schedule their dissertation proposal no later than September 15 prior to the beginning of the fourth year in the program, and propose no later than December 15 of that year.

The usual format is a 1hr dissertation proposal meeting that features a 30-40min presentation complemented with questions and discussions by the Dissertation Committee. The presentation should start with a research overview accessible to a non-expert (“elevator pitch”), discussion of the contribution relative to the literature, coverage of work accomplished so far, and clear time-line with milestones of work remaining for the dissertation. The candidate should discuss this presentation in advance with the Dissertation Advisor and upload the presentation, together with relevant paper(s), on the Graduate Student Tracking System.

Students who do not meet predetermined deadlines and degree requirements may face **academic probation** and/or risk **exclusion** from the PhD Program. Questions about academic progress and degree requirements should be addressed to each student’s PhD Program Director and/or academic advisor.

At the start of the third year, students will meet with the PhD Program Director to discuss choosing advisors, and the proposal process.

### **3.2 Research and Teaching Assistantships**

Third-year students must satisfy the same research and teaching assistantship requirements as second-year students (see 3.3 above).

### **3.3 Third-year Student Research Seminar**

Third year students are strongly encouraged to give a research seminar in the weekly Operations Seminar Series.

### **3.4 Seminars**

All PhD students are expected to continue to regularly attend operations seminars as described in Section 2.3.

Students who go on the academic job market must present their research in an Operations research seminar at least once before completing the program. It is recommended that this presentation take place before the academic job market. For most students, this means by the end of October in the year they are on the market.

### 3.5 Activity Report and Milestone Tracking on GSTS

All PhD students are required to submit an annual activity report, including summer activity, and keep their record current on the [Graduate Student Tracking System GSTS](#). The activity report is considered as part of qualifying for next-year funding.

Students will receive periodic written progress evaluations from the faculty and the PhD Program Director via GSTS.

### 3.6 Summer Research Activity

Doctoral students are expected to be on campus full time and involved in the research and teaching activities of the department throughout the year, including summer quarter, to qualify for continued funding. **Students who will be away from campus for more than three (3) weeks during an academic quarter need the approval of their PhD Director and dissertation advisor, if students have a dissertation advisor at this point in their studies.** Unexcused absences may disqualify students from receiving financial aid from the Kellogg School of Management and/or Northwestern University.

### 3.7 Dissertation, Final Oral Examination and the Job Market

Students should plan to finish the program in four or five years. Students should discuss their progress towards completion regularly with their dissertation advisor(s).

Each candidate must complete a dissertation demonstrating original and significant research and must pass a final oral examination on the dissertation.

The Dissertation must be defended in front of the Dissertation Committee and accepted by The Graduate School. The rules for the Dissertation Committee composition and approval are the same as for the Dissertation Proposal Committee, and once again, the Kellogg Senior Associate Dean for Faculty & Research must approve the committee. These two committees need not have the same members (though they typically do).

The usual format of the dissertation defense starts with a 30min presentation that is open to the public (the candidate should include in the invitation all OPNS PhD students and faculty), followed by a 20min oral examination by the Dissertation Committee (members of which may provide exam questions in advance) that is closed to the public, and finished by deliberation by the Dissertation Committee.

The candidate should discuss this presentation in advance with the Dissertation Advisor and will upload the presentation on the Graduate Student Tracking System.

(Defending your dissertation: <https://www.mcsweeneys.net/articles/faq-the-snake-fight-portion-of-your-thesis-defense>)

Students should also be aware that the academic job market takes place in the Fall and Winter for jobs starting the following academic year. This means that it is necessary to have at least one strong piece of original research ready to use as a job market paper by, at the latest, October of their final year in the program.

It is also essential for any student who is even remotely considering being on the job market to discuss this with their advisor and notify a PhD Program Director by the beginning of the summer before.

### **3.8 Progress Guidelines**

Third-year students' progress is measured by their research progress (judged by their advisors), their integration into the research and teaching environment through seminar attendance and RA/TA work, and, most importantly their dissertation proposal defense. Students must successfully propose before the start of the fourth year and must have performed satisfactorily in the other aspects to be in good standing. Students who are not in good standing should meet regularly with the PhD Program Directors to ensure that they return to good standing as soon as possible. A student who is not in good academic standing at the end of the third year or at any time during the fourth and later years may lose financial support and may be asked to leave the program.

In the fourth and later years, good academic standing requires ongoing, substantial progress towards completion of the dissertation. The chair of the dissertation or dissertation proposal committee must certify, on the annual Activity Report, that substantial progress is being made.

### **3.9 Funding**

For students in good academic standing funding is provided for up to five years. For students in their sixth year and beyond, no systematic funding program beyond health insurance should be expected.

### **3.10 Degree Completion**

The Graduate School has set a maximum time limit of nine years for successful completion of the dissertation. For more details, see the Graduate School bulletin.

## 4 Research Support

The Operations Department, in conjunction with the Kellogg and the Graduate School, is committed to providing [research support to PhD students](#). This includes a [computer subsidy](#) and [conference travel funding](#), in addition to providing a limited supply of computers, software, office space, basic office supplies, and photocopying.

Kellogg doctoral students may apply for additional research funding, such as data, software, and research assistants. Applications are submitted and reviewed by each student's director of graduate study (DGS), the student's main advisor, the faculty director for the PhD Program, and, when appropriate, Kellogg's senior associate dean for faculty and research.

Kellogg doctoral students may apply for additional research funding, such as data, software, experimental research/subject fees, and research assistants. Submitted applications must be approved by the student's advisor, the faculty director of the PhD program and, in some instances, Kellogg's senior associate dean for faculty and research.

## 5 Dismissal

While every effort is made to admit only students who can satisfactorily complete our program, some students are occasionally asked to leave the program. Failure to pass the Qualifying Examinations and failure to satisfactorily propose are the most common reasons for dismissal. In the event the PhD Program Director determine that a student has failed their Qualifying Examination or otherwise failed to meet their academic standing requirements, or in the event the proposal committee decides that a student has not met the proposal requirements, a committee consisting of the PhD Program Director, the faculty who teach in the PhD program, and the proposal committee (if relevant) will evaluate whether the student should be asked to leave the program. All recommendations to dismiss a student will also be reviewed by the Kellogg Associate Dean of Faculty. This committee will also evaluate whether students who are asked to leave the program have met the requirements for a master's degree described in 2.8. The Graduate School may set additional requirements for the Master's degree.

If, at any time, a student feels the need to better understand the rules that apply to them or has any questions related to this document, they should talk to the PhD Program Director.