

**Division of Computational & Data Sciences**

# Doctoral Student Handbook

Released and Effective as of August 16, 2021

|  |           |
|--|-----------|
| <b>Welcome to Division of Computational &amp; Data Sciences (DCDS)</b> | <b>3</b>  |
| <b>Introduction to the DCDS Doctoral Program</b>                       | <b>4</b>  |
| Overview of Program Requirements                                       | 4         |
| Academic Tracks  | 4         |
| <b>Getting Started: The First Year</b>                                 | <b>6</b>  |
| Getting Started as a New Student                                       | 6         |
| Number and Role of Research Advisors                                   | 6         |
| Finding Research Advisors: Matching Process                            | 7         |
| How to Arrange a Rotation with Prospective Advisors                    | 7         |
| Deadline for Matching with Research Advisors                           | 7         |
| Changing Research Advisors   | 8         |
| <b>Course Information</b>  | <b>9</b>  |
| Academic Requirements  | 9         |
| Core Courses   | 9         |
| Domain Depth   | 10        |
| Coursework Planning  | 11        |
| Transfer Credits   | 11        |
| Enrollment Requirement   | 12        |
| <b>Training in Teaching</b>  | <b>13</b> |
| Mentored Teaching Experience   | 13        |
| Pedagogy Training  | 14        |
| <b>Program Milestones</b>  | <b>15</b> |
| Schedule   | 15        |
| Oral Qualifying Examination  | 15        |
| Procedure of the Examination   | 16        |
| Possible Outcomes and Retakes  | 17        |
| Dissertation Proposal  | 17        |
| Procedure of the Proposal Defense                                      | 18        |
| Possible Outcomes and Retakes  | 19        |
| Dissertation Defense   | 19        |
| Procedure of the Dissertation Defense                                  | 20        |
| Possible Outcomes  | 20        |
| <b>Policies</b>  | <b>21</b> |
| Annual Review of Progress  | 21        |
| Academic Probation and Dismissal                                       | 21        |
| Academic Integrity and Ethics  | 22        |

|                                    |           |
|------------------------------------|-----------|
| Outside Employment and Internships | 22        |
| Time Off                           | 22        |
| Master's Degrees                   | 23        |
| <b>Forms</b>                       | <b>24</b> |

# Welcome to Division of Computational & Data Sciences (DCDS)

Welcome to the Division of Computational and Data Sciences (DCDS) at Washington University in St. Louis (WashU)!

This is a great time to pursue a doctorate in Computational and Data Sciences. With the reliance on computation and data across a range of disciplines, there is a strong need and potential for students trained with deep knowledge of the capabilities and operation of data science techniques, coupled with the domain expertise needed to apply them effectively to the problems under consideration.

Your journey in the DCDS program may be challenging, but we are here to help you through the process. While you will primarily work with your research advisors in your doctoral studies, you are welcome to contact the program directors and track chairs or staff from the Graduate Student Services, who provide administrative assistance to this program.

We very much look forward to seeing you succeed in your research pursuits. You, our Ph.D. students, are critical to the success of the program!

*Dr. William Yeoh, Track Chair, Computational Methodologies, Co-Director*  
*Dr. Patrick Fowler, Track Chair, Social Work & Public Health, Co-Director*  
*Dr. Jacob Montgomery, Track Chair, Political Science*  
*Dr. Jeffrey Zacks, Track Chair, Psychological & Brain Sciences*  
*Catherine Freesmeir, Associate Dean of Graduate Student Services*  
*Holly Stanwich, Assistant Director of Graduate Student Services*  
*Kourtney Shaw, Administrative Coordinator of Graduate Student Services*  
*Cindy Heidorn, Department Accountant*

# Introduction to the DCDS Doctoral Program

This guide describes in detail the procedures and requirements for a Ph.D. in DCDS. The Division implements, and in some cases extends, the requirements imposed by the Graduate School on all students seeking Ph.D. degrees. The requirements imposed by the Graduate School are listed in the general requirements section of the [Graduate School Bulletin](#). We assume that current and prospective students will be the primary users of this guide. The guide often uses “you” and “your,” which are always addressed to the student.

## Overview of Program Requirements

A Ph.D. is primarily a *research degree*, certifying that the recipient is able to conceive and carry out a program of original research. A Ph.D. recipient must also be able to effectively communicate new research findings, both orally and in writing. Finally, the degree certifies a high level of competence and background knowledge in the recipient's subject area.

Ph.D. students learn to formulate and execute a research program with the mentorship and guidance of a research advisor, a faculty member who provides intensive mentoring and guidance throughout a student's doctoral career. The student's dissertation, a substantial original research contribution required to obtain the Ph.D., is typically carried out as part of this research program. Students enter our program without a predetermined research advisor and must find an advisor among the faculty affiliated with DCDS during their first year.

At various points during our students' doctoral careers, they must pass milestones that demonstrate mastery of certain research skills and progress toward the dissertation. Our programs include three major milestones: an oral qualifying examination; a formal dissertation proposal; and completion and defense of the dissertation. In addition to these major milestones, students are expected to present their research regularly, both in external venues such as competitive academic conferences and internally through annual talks in our student seminars.

In addition to performing research leading to a dissertation, DCDS Ph.D. students must complete coursework requirements. Courses include a set of common core curriculum and also a domain depth requirement that depend on their choice of academic track (described below). All Ph.D. students must also satisfy a “mentored teaching experience” (MTE) requirement by assisting faculty members in teaching a course for two semesters (see the section on Mentored Teaching Experience for details).

## Academic Tracks

DCDS offers four distinct academic tracks:

- **Computational Methodologies:** This track focuses on developing novel algorithms and techniques in the areas of machine learning, data visualization, network science, and resource allocation, among other topics. For specifics on this track, go to: <https://datasciences.wustl.edu/computational-methodologies/>

- **Political Science:** This track focuses on many aspects of questions about political behavior, ranging from basic questions about inferring causality from observational and experimental data to understanding the role of social networks in political behavior, and using textual data to understand how legislators communicate with constituents. For more on this track, go to: <https://datasciences.wustl.edu/political-science/>
- **Psychological & Brain Sciences:** This track focuses on human behavior and mental life, and how they relate to brain structure and function, using data from lab behavioral experiments, social media, smartphones, and functional MRI and other brain imaging modalities. Levels of analysis include behavior within an experimental session and across the lifespan, individual differences, and social and political/economic groups. For more on this track, go to: <https://datasciences.wustl.edu/psychological-brain-sciences/>
- **Social Work & Public Health:** This track focuses on the issue of data-enabled and computational techniques to improve social outcomes, broadly defined, considering issues of efficiency, social justice, and equity. To learn more about this track, go to: <https://datasciences.wustl.edu/social-work-public-health/>

A student's choice of academic track depends on their specific interests within DCDS and the interests of the faculty members who serve as the student's advisors.

# Getting Started: The First Year

During your first year in the DCDS Doctoral Program, your most important task is to integrate yourself into the division's research activities by finding a home in one of our research groups. You will also take a full load of courses, including DCDS 499, designed to orient you to graduate research in general and the current research opportunities in DCDS.

## Getting Started as a New Student

1. **Set up your WUSTL key and email address:** All of your communications will come through your WUSTL email address. So, it is important for you to check it regularly.
2. **Check in with the DCDS administrators and get your student ID card:** You will receive information on your workspace/office location. You will complete all HR forms for stipend allocation and you will be directed to get a student ID card. Your student ID card will give you access to buildings, allow you to borrow books from the library, ride the campus shuttle and you can add money to the card to use on campus as well as in participating surrounding businesses.
3. **Check in with the DCDS co-directors for course selection and advising:** The co-directors of the program serve as temporary academic advisors for all DCDS students in their first year. You will need to enroll in DCDS 499 in your first semester and DCDS 500 as well as DCDS 510 in your second semester. The choice of your other courses will depend on your background as well as research interests.
4. **Tour the campus:** Become familiar with the buildings and the labs. The campus offers several dining options, a recreation center for fitness, a chapel, several libraries and many areas for gathering with friends or study groups.

## Number and Role of Research Advisors

Every doctoral student must be mentored by research advisors, faculty members who are responsible for directing their research and academic program. While it is acceptable for students to be mentored by only one research advisor, the expectation is that they are mentored by two research co-advisors in two different academic tracks, reflecting the interdisciplinary nature of their research. In such a case, one of the two advisors will serve as the primary advisor.

It is difficult to overstate your research advisors' influence on your doctoral career. You will meet with them more often than anyone else in the division, long after you have satisfied all course requirements. You will work closely with your advisors on research and will likely publish many joint papers. Your advisors will represent your interests to the division. Finally, your advisors will chair your dissertation committee and will ultimately certify your readiness to graduate.

## Finding Research Advisors: Matching Process

Incoming first-year students are unaffiliated, meaning they do not have research advisors, and they remain unaffiliated until they and a faculty member file an advisor affiliation form with the division. The mechanism by which students become affiliated with faculty members is through the two three-month long rotations undertaken in the fall and spring semesters in the first year. If the first two rotations do not result in a match, then the student may arrange for additional rotations in the summer. The duration of the summer rotations need not be three months long, and should be determined by the rotation advisor and student. As the goal of the matching process is to identify rotation advisors who will serve as your research advisors, your rotation advisors must be faculty members who are affiliated with DCDS.<sup>1</sup>

Students and faculty are discouraged from committing to an advising relationship before the completion of the second rotation. If they do, the student must notify any other rotation host immediately. Faculty members may be reluctant to host a second rotation for a student who has already committed to joining another lab. In this case, the best approach is often for the advisor to help recruit a second rotation host in a research area related to their own.

### How to Arrange a Rotation with Prospective Advisors

You should browse the list of DCDS faculty members and their websites early in the fall semester and send email to faculty members with whom you would like to discuss a rotation. Additionally, a substantial number of DCDS faculty, especially those who are looking to recruit students, will give presentations on their research in DCDS 499, a course that you are required to take in the fall semester of your first year. (See [Core Courses](#) for more information on this course.) Should your research interests align with the topics presented, you should reach out to the faculty member enquiring if it is possible to rotate with them. The first step is to arrange a meeting. Before the meeting, do your homework by learning about the faculty member's research from their web pages and publications. Ideally, you want to have a rotation confirmed at least a week or two before it is supposed to start.

Once a rotation is confirmed, the rotation mentor will need to fill a [rotation commitment form](#). After each rotation, you will need to fill a [rotation completion form](#).

### Deadline for Matching with Research Advisors

**You must find your research advisors by August 15 in the summer before your second year in order to continue in the program.** Students are strongly encouraged to match with their research advisors as soon as possible after completing the second rotation. That is the natural time to discuss committing to a mentoring relationship with faculty members. That commitment requires filing a [lab affiliation form](#). If you and your prospective advisors have not filed the affiliation form, you do not have research advisors.

---

<sup>1</sup> Contact the co-directors if you would like to rotate with a faculty member who is not affiliated with DCDS.



As noted previously, you will receive a letter naming a faculty member, usually one of the co-directors of the program, as your temporary academic advisor. This person is temporarily assigned to help you select your courses in the first year and is not your research advisor.

## Changing Research Advisors

The advising relationship is established and continued only by the mutual consent of student and faculty members. You have the option at any time to seek a new research advisor. If you feel that switching research advisors is in your best interest, the faculty will do what we can to try to make the transition possible, beneficial, and amicable for all involved. Similarly, if the faculty member chooses to end the advising relationship, and if you are making adequate progress toward a Ph.D., we will help you find a new advisor if possible.

# Course Information

Graduate students with research and assistantship duties will typically enroll in course loads commensurate with the requirements of these duties. Students otherwise employed full-or part-time, on-or-off-campus, will determine a satisfactory reduced course load with their advisors. International students on student visas are required to maintain full-time enrollment status with 9 credits or more per semester.

## Academic Requirements

Students need 72 credits to obtain a doctorate degree from WashU. Credits come from two kinds of work:

- **Regular Courses:** At least 37 of your credits must be from regular (non-seminar) courses eligible for graduate credit. These include credits from courses that satisfy the core and domain depth requirements. These requirements are discussed later.
- **Research Credit:** At least 24 of your credits must be research credit, taken in the form of DCDS 600: Computational & Data Sciences Doctoral Research. Research credit must be arranged with your research advisors each semester. You may take up to 12 research credits per semester.

## Core Courses

Students need to take the following core courses:

- **DCDS 499: Introduction to Graduate Research in Computational and Data Sciences.** Students must take this course during their first fall semester. The course presents topics and ideas that do not need detailed specific computational or substantive backgrounds, primarily by DCDS faculty about the work they do. An important function of this course is to help you narrow your choice of potential research areas and identify potential rotation mentors (see section on Matching Process for more details). Additionally, the course will also include discussions and assignments to help develop critical research skills, such as selecting good problems, conducting literature reviews, effective time management, and cognizance of ethical implications in research.
- **DCDS 500: Computational and Data Sciences Research Explorations.** Students must take this course during their first spring semester. The course lays the foundation for future study and success in transdisciplinary research involving computational and data sciences. Opportunities exist to engage with the conceptual and technical challenges emerging from the increasingly ubiquitous availability of extensive datasets capturing many aspects of human life, social behavior, and scientific discovery. The course emphasizes technical and ethical issues of knowledge development, causal inference, and justice in the context of complex data. Students work in diverse teams to apply methods to case studies.
- **DCDS 510: Introduction to Data Wrangling.** Students must take this course during their first spring semester. The course introduces students to tools and techniques for how to collect, maintain, and process large-scale datasets of the kind generated when

studying people and social systems. Students learn methods for generating information from multiple sources (e.g., static survey data, dynamic data accessed via API), as well as evaluating information for flaws (e.g., missing or erroneous entries, redundant entries, bias stemming from data collection). The course provides opportunities to ingest data, perform analyses, and document findings using an electronic notebook for reproducibility.

- **Pol Sci 581: Quantitative Political Methodology I or Psych 5066: Quantitative Methods I.** The course introduces students to scientific inquiry and basic statistical tools, primarily covering the linear regression model and focusing on how to collect, manage, and analyze data using computer software, and how to effectively communicate to others results from statistical analyses.
- **Pol Sci 582: Quantitative Political Methodology II or Psych 5067: Quantitative Methods II.** The course covers advanced methods of statistical analysis in computational and social sciences. Topics include maximum likelihood estimation for various cross-sectional, time series, and measurement models.
- **CSE 502: Fundamentals of Computer Science.** This is a fundamental course studying key algorithms, data structures, and their effective use in a variety of applications. It emphasizes the importance of data structure choice and implementation for obtaining the most efficient algorithm for solving a given problem. A key component of this course is worst-case asymptotic analysis, which provides a quick and simple method for determining the scalability and effectiveness of an algorithm. We expect many students will already have this background – it is intended as a pathway for students with little computational training.
- **CSE 417T: Introduction to Machine Learning.** The course covers the fundamental principles of supervised learning, including generalization, overfitting, regularization, cross-validation, and model selection, and also the basics of core ML techniques and algorithms, including linear models like logistic regression, gradient descent, tree-based and ensemble methods, kernel methods, and artificial neural networks.
- **CSE 517A: Machine Learning.** This is an advanced machine learning course that follows CSE 417T and includes models like kernel methods, Gaussian processes, deep neural networks, PCA, and SVD, in addition to discussion of general techniques to deal with problems like unsupervised learning, semi-supervised learning and graph learning.

If you believe you have sufficient background for any of these courses, you may contact the co-directors to request for those courses to be waived.

## Domain Depth

Depending on students' choice of academic track, they must complete the following domain depth requirements:

- **Political Science:** Students must complete three substantive classes in one subfield (American politics, comparative politics, international relations) from a specified list for each subfield.
- **Psychological and Brain Sciences:** Students must complete three substantive graduate-level classes in one subfield (brain, behavior and cognition, clinical science,

social/personality, development and aging). With permission, students may substitute the PBS Research Methods course (PBS 5011) for one of those substantive classes depending on their background in psychological science.

- **Social Work and Public Health:** Students must complete a doctoral seminar series, including conceptual foundations of social science, advanced research methods, and a theory seminar, plus an advanced substantive course from an approved list in their area of interest. With permission from the co-directors, students may substitute core courses for substantive classes.
- **Computational Methodologies:** Students must take Advanced Algorithms (CSE 541T) and either Introduction to Artificial Intelligence (CSE 412A) or Bayesian Methods in Machine Learning (CSE 515T). In addition, students must take two substantive classes in their area of interest (one of the other three tracks) from among the classes acceptable for students in that track as noted above.

## Coursework Planning

In general, there are no strict requirements for when you will need to take any of your required courses, except for DCDS 499, which you must take in the fall semester of your first year, and both DCDS 500 and DCDS 510, which you must take in the spring semester of your first year.

When planning for your coursework, keep in mind that it may be tempting to complete your core and domain depth requirements as soon as possible so that you have more time to use the knowledge gained from those courses in your dissertation research. However, you should also not load up on courses in your second and third years as that may prevent you from making substantial research progress. Therefore, it is key that you strike a good balance so that you are making progress on both satisfying course requirements as well as your research.

Lastly, plan your courses in advance as some courses are not offered every semester and some courses have prerequisites that you may not have satisfied yet. It is also recommended that you discuss your plan with your advisors.

## Transfer Credits

A maximum of 24 credits of graduate credit earned at another institution may be applied toward your Ph.D. requirement. Transfer credit is granted only for regular courses (not seminars or research credit) that are appropriate substitutes for work that would have otherwise been done as part of your Ph.D. program. A course taken at another institution must meet all of the following requirements to be eligible for transfer credit:

1. You must have received a grade of B or higher for the course.
2. You must have taken the course within the past 10 years.
3. The course must be recommended by your advisors.
4. The division must approve the transfer after reviewing the course's content and your grade for the course. Generally, the decision to approve is made with consultation by a faculty member with expertise in the subject area of the course to be transferred.

To request for transfer credits, please fill out this [application form](#) for each course that you wish to transfer. Please also send your transcript in electronic form to the division co-directors and inform them that you have filled out the forms requesting credit.

## Enrollment Requirement

All Ph.D. students must be enrolled full time every semester until graduation. Full-time enrollment is achieved by registering for at least 9 units per semester. If you have reached the 72 credits required by the program, you can maintain full-time status by registering for either *Full-time Graduate Research/Study (LGS GSAS 9000)* or *Full-time Graduate Study in Absentia (LGS GSAS 9001)* that indicates the student's full-time engagement in research or academic writing. Both of these courses require division approval. LGS GSAS 9001 is for students who will be completing research away from the university. These cases need to be approved by the Graduate School and the student's advisors in addition to the division. Students are allowed to register for LGS 9001 for up to four fall/spring semesters, and these are counted towards the student's program length.

# Training in Teaching

The skills required to obtain a Ph.D. include not only mastery of core and specialized knowledge on computational and data sciences, but also the ability to communicate this knowledge to others. Teaching skills are especially important if you choose to pursue an academic career, but similar abilities are required in industrial research, governmental roles, and many areas of public life. Our Ph.D. program therefore requires you to satisfy teaching requirements as part of obtaining your degree.

There are two aspects of the teaching requirement that must be completed prior to graduation:

- **Mentored teaching**, by acting as a teacher or course teaching assistant (TA).
- **Pedagogy training**, before and during the mentored teaching experience.

## Mentored Teaching Experience

Students are required to complete **two semesters** of mentored teaching experience (MTE). To satisfy one semester of MTE, students need a minimum of 13 hours of contact with students, organized into two components:

1. At least 3 hours giving lectures, leading recitation sections, or leading laboratory sections. The defining features are that:
  - a. The MTE student must prepare and plan the session in advance, and
  - b. The MTE student must be in charge of a group of 3 or more students engaged in some form of planned, structured learning experience.

**Office hours or one-on-one help do not satisfy this requirement.**

2. At least 10 hours of some combination of the following:
  - a. Helping students one-on-one, in person. These can be in scheduled office hours or ad hoc meetings.
  - b. Designing new assignments with the course instructor, grading the assignments, and writing a one-page reflection of the assignments, including strengths and weaknesses. The reflection should be turned in to and discussed with the course instructor.

In addition to the specific requirements above, MTE students are required to help in course administration, such as grading assignments, answering students' questions online, and other such duties as assigned by the course instructor. The total time commitment for the MTE should be similar to that of a 3-credit course (i.e., not more than about 12-14 hours per week on average). However, the time required may vary significantly from week to week. Students should enroll in *Mentored Teaching Experience (LGS GSAS 600)* in the semesters that they are satisfying their MTE requirement.

MTE mentors (i.e., the instructor of the course that the student is an MTE for) must be DCDS faculty members. If you would like to MTE for an instructor who is not a DCDS faculty member

and you have your advisors' approval to do so, contact the co-directors to request for an exception.

The MTE mentor should submit an [MTE commitment form](#) before the start of the semester.

## Pedagogy Training

The university has a [Teaching Center](#) that provides many short workshops on teaching techniques and approaches. These span the range from university policies to the latest teaching techniques based on empirical research. Their most basic workshop is *Graduate Student Mentored Teaching Orientation*, which is offered about a week to 10 days before the beginning of the fall semester. Students must register and participate in this workshop in the summer before their second year. Students must also register and participate in two additional approved workshops conducted by the Teaching Center by the end of their fourth year of doctoral studies. Documentation of attendance by the Teaching Center will be used to verify this requirement.

The Teaching Center also offers a [Professional Development in Teaching program](#), which includes a number of certifications at a number of different levels. Note that, with approval from the Teaching Center, students may use their MTE training to replace an advanced-level workshop to satisfy requirements of that program. However, those students must have 6 hours of qualifying instruction time (e.g., giving lectures, leading recitation sections, and leading laboratory sections), instead of the default 3 hours of qualifying instruction time for the MTE.

Students are also required to deliver a minimum of four oral presentations at journal clubs, seminar series, scientific conferences, or retreats. Presentations given as part of the MTE, laboratory/group meetings, qualifying examinations, dissertation committee meetings, dissertation proposal defenses, or dissertation defenses will not satisfy this requirement. Students will report completion of presentations as part of the Annual Review of Progress.

# Program Milestones

Your graduate career is marked by a series of milestones achieved on the way to your doctorate. At each milestone, you will demonstrate certain skills and abilities critical to success in computational and data sciences research. These milestones serve both to give you immediate targets at which to aim and to give us ways to assess your progress towards your doctorate.

## Schedule

| Milestone  | Ideal Time (semester) | Time Limit (semester) |
|--|-----------------------|-----------------------|
| Find an advisor and file commitment form             | 2nd                   | 2nd + summer          |
| Pass oral qualifying examination                     | 4th                   | 4th + summer          |
| Submit and successfully defend dissertation proposal | 5th-6th               | 7th                   |
| Submit and successfully defend dissertation          | 10th-12th             | 14th                  |

In the very rare case in which a student fails to find an advisor by August 15 in the summer before their second year, they are dismissed. Failure to meet the deadlines for passing an oral examination or defending a dissertation proposal will result in an academic probation, which gives the student a short additional time within which to complete the milestone. Failure to complete within that additional time can lead to dismissal. The 7 year limit for completing the dissertation is imposed by the university. If a student has not successfully defended their dissertation within 7 years but their advisors feel that they are making progress and are close to completion, it is possible to petition the division for an extra year. If the division approves the petition, then it will be submitted to the Graduate School, which must also approve.

## Oral Qualifying Examination

The oral qualifying examination tests your ability to read deeply the research literature on a particular research topic, to synthesize and critically evaluate it, to present your synthesis in a scholarly and professional oral presentation, and to answer questions about the literature that you have read. All of these skills are essential for being able to pursue research at a doctoral level.

To the extent that the research topic for your oral examination is related to your doctoral research area, the time you spend preparing for the examination should help you make progress towards your degree. The examination will also be one of many opportunities for you to build confidence in your research and oral presentation skills.



## Procedure of the Examination

Ideally during your fourth semester, you initiate the oral qualifying examination by meeting with your advisors to identify a research area for the examination and 10-50 published papers, which may include book chapters, that span that area. The number of publications that reasonably span a research area can substantially differ across disciplines. Consequently, the large range of papers is to give your advisors and you flexibility in determining an appropriate number of papers to consider. Out of those 10-50 papers, you are to focus on 3-5 core papers, where you will present and discuss in depth during the examination and the remaining papers can be discussed at a more cursory level.

Together with your advisors, you will then decide which other faculty members to ask to serve on your examination committee. Your committee must include three DCDS faculty members that span at least two academic tracks, one of which is your track.

It is the student's responsibility to contact prospective committee members, tell them the topic, and ask them to serve. Faculty members may from time to time decline to serve on a committee, in which case others must be asked. The committee may suggest increasing or decreasing the number of papers discussed as well as replacing one or more of the papers, especially if they are too similar or too diverse.

As part of your preparation, you are expected to read each selected paper in depth to understand both the significance of its results and the details of how these results were achieved. Your preparation should cover the whole area spanned by the 3-5 core papers, not just the papers themselves. You will likely need to do significant background reading to understand current work in the area and to place it in its historical context. A good place to start is with the most relevant of the works cited by your core papers and those that cite your core papers. You should have well-informed opinions about the quality of the work in the selected papers and how their approaches relate to each other and to other work in the area. You should also formulate well-reasoned opinions about the future of the research area and the role, if any, that each of the core papers is likely to play in it.

After completing your research and synthesizing the literature in your mind, you should prepare a polished, professional, conference-style oral presentation of around 45 minutes that presents an overall view of and direction for work in the area of the examination.

**Important:** Your presentation should include a summary of important ideas from the selected core papers, their significance, and how they relate to each other and to other relevant work. However, it is not sufficient to give a talk focused on these core papers alone. **A talk that merely summarizes the 3-5 core papers is a failing talk.** Rather, you must demonstrate that, having read both the selected core papers and other relevant literature, you have synthesized a clear understanding of the current state of research in the area and can propose and defend reasonable directions for further, novel research in it.

During and after your presentation, the committee will ask you questions about the substance of the papers and their implications for your research area and your own planned work. Please schedule two hours for your exam to allow sufficient time for questions. At the end, the committee will confer in private to determine whether you have passed the exam.

The chair of the examination committee will inform the division co-directors on the outcome of the examination.

## Possible Outcomes and Retakes

There are only two possible outcomes of the oral exam: Pass or fail. There are no conditional passes or minor revisions. Students who fail the first time may take the exam one more time, for a total of two attempts. When a student retakes the exam, the new committee should include at least one person who has served on the previous exam committee for the student.

Students who have not passed their oral examination by the end of their 5th semester will be placed on academic probation, with the condition for return to good standing being to pass the examination.

## Dissertation Proposal

The next major milestone in the Ph.D. program is the proposal of a topic for dissertation research. You should choose your dissertation topic and formulate a plan of research on this topic in consultation with your research advisors. The planned research must be original, novel, and significant enough to warrant publication.

When you have selected a research topic, you must describe your research plan in a written dissertation proposal. Proposals are typically 15 single-spaced pages in length, not counting the bibliography/references section and appendices. Learning how to condense your ideas to a proposal of limited length is a very important research skill in industry as well as in academia. The proposal should include the following information:

- Motivation for the planned research;
- One or more goals that you will achieve through your research program;
- Background sufficient for someone educated in computational and data sciences (but not necessarily in your research area) or someone familiar with your domain area to understand your goals and their significance;
- A review of existing work related to your research plan, indicating how your planned research is novel;
- High-level details of the planned research, including challenges, methods, and deliverables, sufficient for an expert in your area to evaluate its technical feasibility; and
- A timeline indicating when you plan to achieve your goals and when you plan to complete the dissertation.

A good model for the dissertation proposal is an NSF or NIH grant proposal. Your advisors or another faculty member can provide examples of such proposals. Like a grant proposal, the dissertation proposal must provide enough technical detail to be compelling, but it must also leave room for discovery as part of the research process. Furthermore, some of the aims of the proposal may turn out not to be feasible once the research is fully underway. The proposal is a roadmap and a plan, but not a guarantee that every point of interest on the map will be visited.

## Procedure of the Proposal Defense

You should propose as soon as you are able to provide background, research goals, and methodological approaches necessary to convince a dissertation committee that the research is both significant and feasible. There are no other requirements that must be met before proposing. For example, there is no requirement that you must have published a paper before you propose.

Together with your advisors, you will then decide which other faculty members to ask to serve on your dissertation committee. Your committee is typically chaired by your primary research advisor and must include a total of at least five members, who collectively must meet two criteria imposed by the Graduate School:

1. Four of the five members must be tenured or tenure-track WashU faculty; one of these four may be a member of the Emeritus faculty. The fifth member must have a doctoral degree and an active research program, whether at WashU, at another university, in government, or in industry.
2. Three of the five members must be DCDS faculty members (“inside” members); at least one of the five must not (“outside” members). The required “outside” member may be at WashU, at another university, in government, or in industry. The only requirement is that that person has a doctoral degree and an active research program.

In addition to the Graduate School requirements, the DCDS program requires that the **DCDS committee members span at least two academic tracks**. Your committee may be as large as you wish, so long as some subset of five members satisfies the above requirements. The Dean of the Graduate School is the final arbiter of what constitutes an acceptable committee.

It is the student’s responsibility to contact prospective committee members, tell them the topic, and ask them to serve. Faculty members may from time to time decline to serve on a committee, in which case others must be asked. You should supply each committee member with a copy of your proposal at least 14 days prior to the examination or earlier if requested by the committee.

The proposal defense must be conducted in a public setting before your committee. Attendance by a minimum of four members of your committee, including the committee chair and an “outside” member, is required for the defense to take place. This provision is designed to permit your defense to proceed in case of a situation that unexpectedly prevents one of the five members from attending.

The proposal defense consists of three parts:

1. This first part is open to the public. You will give an oral presentation of around 45 minutes describing the content of your proposal, including its background and motivation, its aims, related work, the research plan itself, and the timeline for completion. The committee members and audience may ask you questions about your presentation.
2. The second part is closed to the public. The committee will question you further about details of the research plan and any issue raised by their reading of the proposal.
3. Finally, the committee will deliberate privately to determine whether to accept the dissertation proposal.

You should schedule two hours for this examination.

The chair of the dissertation committee will inform the division on the outcome of the examination.

## Possible Outcomes and Retakes

There are only two possible outcomes of the proposal defense: Pass or fail. Students who fail the first time may defend their proposal again one more time, for a total of two. Note that even if the proposal is accepted, the committee may still recommend changes to the research plan and may require you to provide regular oral and/or written updates on your progress towards the proposal's specific aims.

Students who have not successfully defended their dissertation proposal by the end of their 7th semester will be placed on academic probation, with the condition for return to good standing being to successfully defend their dissertation proposal.

Once you have successfully defended your dissertation proposal, you should submit a [Title, Scope, and Procedure Form](#) to the Graduate School as soon as possible. This form briefly describes the planned work of the dissertation. The "scope" of your dissertation indicates the specific area of study and the questions to be answered, while the "procedure" briefly describes how you will carry out the work. You should have the form filled out and ready for signatures prior to the proposal defense. At least three DCDS faculty from your committee, including your advisors, must sign the form. Ideally the entire committee should sign. The form must be submitted to the Graduate School at least six months before the dissertation defense, or by the end of the fourth year, whichever comes first.

## Dissertation Defense

At the conclusion of your doctoral research, you will produce a written dissertation describing the results of your doctoral research, along with sufficient context to make the importance of the question you addressed and the implications of your findings clear. It should also provide sufficient details for a specialist in your field to verify your findings. This dissertation must be

produced according to the [Graduate School's Dissertation Guide](#). Please see this guide for detailed instructions about formatting, which materials and forms to submit to the Graduate School before and after the examination, and how to file an *intent to graduate* in the semester in which you defend your dissertation.

## Procedure of the Dissertation Defense

Using a procedure similar to that of the proposal defense, your dissertation defense must be conducted in a public setting before your committee, whose composition and attendance requirements are the same as those of the proposal defense. You should supply each committee member with a copy of your dissertation at least 14 days prior to the examination, or earlier if requested by the committee.

Additionally, you will need to submit a [Dissertation Defense Committee Form](#) to the division three weeks before your scheduled defense.

## Possible Outcomes

In the vast majority of cases, the dissertation committee votes unanimously for approval of the defense. However, they may request changes to the dissertation that must be completed before submission to the Graduate School. In the rare case that there are concerns that cannot be resolved through subsequent revisions, and which therefore result in dissenting (negative) votes, the chair of the dissertation committee will [refer the case to the Graduate School for resolution](#).

Students who have not successfully defended their dissertation by the end of their 14th semester will be dismissed from the program. However, if their advisors feel that they are making progress and are close to completion, it is possible to petition the division for an extra year. If the division approves the petition, then it will be submitted to the Graduate School, which must also approve.

Once you have successfully defended your dissertation, you should submit a [Final Examination Approval Form](#) to the division. You should have the form filled out and ready for signatures prior to the defense.

# Policies

## Annual Review of Progress

Each spring, the DCDS steering committee, which consists of all the track chairs, reviews the progress of each student in the program. The first step in the annual review is for you to fill a form describing your progress, the challenges you faced, and your goals for the coming year. Using this information, together with feedback provided by your advisors, the committee will discuss your academic and research progress and come to a consensus on the feedback to provide to you.

## Academic Probation and Dismissal

The Graduate School has a [policy on probation and dismissal for academic reasons](#). It describes the rules governing the procedures to follow for students who fail to meet the timeline for milestones or fail to make sufficient progress in research. For example, it specifies that all Ph.D. students must maintain a GPA of 3.0 or higher and are expected to maintain continuous full-time status until their final semester.

*Academic probation* is the mechanism that the Graduate School provides for formally expressing concerns to a student about their progress, officially recording those concerns, and setting the conditions for return to good standing. It is important to note that being on academic probation does not mean that you are expected to be dismissed from the program -- the vast majority of probations are followed by a return to good standing. However, it is a strong signal from the faculty that you need to make a mid-course correction; you need to be doing something differently than what you have been doing. If you do not change course, you are at risk of dismissal.

When a student is put on academic probation, they receive a formal letter stating the duration of the probation and the conditions for returning to good standing. If the student does not meet the conditions in the specified time period, the result may be either dismissal from the program or a second probation. Failure to return to good standing after a second probation for the same cause will result in dismissal.

The most common causes of academic probations are failure to meet the recommended timeline for milestones. It is your responsibility to keep track of the milestones and timeline. Academic probations may also be issued for failure to make sufficient progress in research. If a student and their advisors have a healthy relationship with good communication, this should never come as a surprise to the student. The advisors should communicate concerns informally before they reach the level of a probation and the student should be sensitive to those signals. Good communication is the responsibility of both parties. If you do not feel confident that you know what your advisors think about your progress in research, you should ask. Try to keep a

mental model of what your advisors think of you and to make sure it is based on regular communication.

## Academic Integrity and Ethics

We expect doctoral students to maintain a high standard of academic integrity. This standard includes integrity in both your coursework and your research activities. Failure to abide by the university's standards of academic integrity can result in your dismissal from the Ph.D. program. For details on expectations, policies, and procedures associated with academic integrity, please see the Graduate School's [academic integrity policy](#). If you have any questions or uncertainties, please do not hesitate to ask your instructor (for courses), your advisors (for research), or the program co-directors for rare circumstances in which you do not feel comfortable with these other options.

## Outside Employment and Internships

Full-time Ph.D. students receiving fellowships, traineeships, or assistantships are required to devote 100% effort to their graduate studies. As such, they are not permitted to engage in any outside employment without special permission of the program co-directors.

In some areas of DCDS, students may pursue research internship opportunities. An internship experience generally involves activities that complement the graduate education received by the student at WashU. For example, they may be research activities conducted at a government or private research laboratory or assisting non-profit organizations in their social work programs. Students do not receive graduate assistantship support during their internships; rather, they are paid by their employer. If a student is supported by fellowships or traineeships, they should consult the requirements of their specific fellowships or traineeships.

Any student contemplating an internship must first obtain their advisors' permission. International students on F-1 visas need a work permit to take an outside internship. These permits can be obtained through the University's [Office of International Students and Scholars \(OISS\)](#). Please consult OISS for additional recommendations, requirements, and procedures related to internships.

## Time Off

Ph.D. students receiving fellowships, traineeships, or assistantships are expected to commit themselves fully to their studies and research regardless of whether classes are in session. Intersession periods listed in the [University Academic Calendar](#) denote times when classes are not in session. Students should, however, utilize these periods to further their studies and research. Intersession periods are not time off for students receiving a stipend and students are expected to work full time on research during these periods.

Students on full stipend are permitted to take a maximum of two weeks of vacation during the calendar year and are expected to communicate the timing of that vacation with their research advisors. In addition, students are permitted to take the university scheduled holidays. Additional time off can be arranged but must be approved ahead of time by your research advisors (if you have one) or the program co-directors (if you do not). Absences of research assistants must be scheduled so as not to impede the progress of an ongoing research project and should be cleared with the research advisors.

## Master's Degrees

Doctoral students may find that they meet the requirements for a master's degree as they complete their studies. Those who wish to obtain a master's degree must first discuss this with their research advisors and obtain their approval to add the master's degree to their program of study. Once they have the approval of their research advisors, they should contact the director for the master's program in which they plan to pursue the degree, and ask for formal admission to the program. Doctoral students should note that transferring courses into a master's program is done on a course-by-course basis, and should consult the master's handbook for that procedure.



# Forms

- [Rotation Commitment Form](#)
- [Rotation Completion Form](#)
- [Lab Affiliation Form](#)
- [MTE Commitment Form](#)
- [Transfer Credit Request Form](#)
- [Title, Scope, and Procedure Form](#)
- [Dissertation Defense Committee Form](#)
- [Final Examination Approval Form](#)