

Computer Science
MS Graduate
Study Manual

2021 –2022

Department of Computer Science

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2 Welcome!

We thank you for pursuing your graduate study with us in the Department of Computer Science (CS).

The goal of this manual, updated annually, is to provide a reliable authoritative guide to the CS Department requirements and policies for our MS program. We all work together to make the Department a supportive, inclusive, and enthusiastic community for world-class research and scholarly advancement.

Please don't hesitate to contact the Director of the CS Master's Program whenever you need clarifications, advice, referrals, or just a sympathetic ear. We are here to help. Please contact and confer with us to ensure you stay connected with all the many people and opportunities afforded to you as part of Northwestern's graduate community.

This manual is maintained by the Director of Graduate Studies and the Director of the CS MS in the Department of Computer Science. Our departmental policies are guided by our parent school, the McCormick School of Engineering and Applied Sciences (MEAS) and Northwestern's governing body for all graduate studies, The Graduate School (TGS).

Resource Links:

- CS Dept: <https://www.mccormick.northwestern.edu/computer-science/graduate/>
- CS academics: <https://www.mccormick.northwestern.edu/computer-science/academics/graduate/>
- ECE Dept: <https://www.mccormick.northwestern.edu/electrical-computer/>)
- ECE academics: <https://www.mccormick.northwestern.edu/electrical-computer/academics/graduate/>
- McCormick Graduate Programs: <https://www.mccormick.northwestern.edu/academics/graduate/>
- The Graduate School (TGS): <https://www.tgs.northwestern.edu/>
- Northwestern Student Affairs: <https://www.northwestern.edu/studentaffairs/index.html>

Director, MS Program: Christopher Riesbeck: dgs-ms@cs.northwestern.edu, ms-admissions@cs.northwestern.edu

Director, PhD Graduate Studies: Peter Dinda: dgs-phd@cs.northwestern.edu

Director, PhD Graduate Admissions: Fabián Bustamante: phd-admissions@cs.northwestern.edu

CS Graduate Affairs Coordinator: Judith Hernandez: csgrad@cs.northwestern.edu

2.1 Diversity Statement

A diverse student population is a key element of the educational experience of students in The Graduate School (TGS). Diversity presents itself in many different forms such as: socioeconomic status, race or ethnicity, religion, gender, sexual orientation, nationality or place of origin, disability, unique work or life experience, etc. It is the goal of TGS to cultivate an environment that values diverse backgrounds, approaches, and perspectives — all essential ingredients for true academic excellence.

2.2 Nondiscrimination Statement

Northwestern University does not discriminate or permit discrimination by any member of its community against any individual on the basis of race, color, religion, national origin, sex, pregnancy, sexual orientation, gender identity, gender expression, parental status, marital status, age, disability, citizenship status, veteran status, genetic information, reproductive health decision making, or any other classification protected by law in matters of admissions, employment, housing, or services or in the educational programs or activities it operates. Harassment, whether verbal, physical, or visual, that is based on any of these characteristics is a form of discrimination. Further prohibited by law is discrimination against any employee and/or job applicant who chooses to inquire about, discuss, or disclose their own compensation or the compensation of another employee or applicant.

Northwestern University complies with federal and state laws that prohibit discrimination based on the protected categories listed above, including Title IX of the Education Amendments of 1972. Title IX requires educational institutions, such as Northwestern, to prohibit discrimination based on sex (including sexual harassment) in the University's educational programs and activities, including in matters of employment and admissions. In addition, Northwestern provides reasonable accommodations to qualified applicants, students, and employees with disabilities and to individuals who are pregnant.

Any alleged violations of this policy or questions with respect to nondiscrimination or reasonable accommodations should be directed to:

Northwestern's Office of Equity
1800 Sherman Avenue, Suite 4-500
Evanston, Illinois 60208
847-467-6165
equity@northwestern.edu

Questions specific to sex discrimination (including sexual misconduct and sexual harassment) should be directed to:

Northwestern's Title IX Coordinator in the Office of Equity
1800 Sherman Avenue, Suite 4-500
Evanston, Illinois 60208
847-467-6165
TitleIXCoordinator@northwestern.edu

A person may also file a complaint with the Department of Education's Office for Civil Rights regarding an alleged violation of Title IX by visiting

www2.ed.gov/about/offices/list/ocr/complaintintro.html

or calling 800-421-3481. Inquiries about the application of Title IX to Northwestern may be referred to Northwestern's Title IX Coordinator, the United States Department of Education's Assistant Secretary for Civil Rights, or both.

3 MS Program in Computer Science

This section discusses all academic aspects of the process of obtaining an MS degree in Computer Science from the Computer Science department. For information on the MS degree in Computer Engineering, see the Graduate Study Manual for the CE program:

<https://www.mccormick.northwestern.edu/electrical-computer/documents/graduate/ce-graduate-manual.pdf>

We encourage MS students to assemble their own informal whole-degree study plans early and review them with the Director of the MS program.

3.1 Advising

All MS students must consult their academic advisor before registering for courses on CAESAR. At a minimum, MS students must file a ‘study plan’ of proposed courses before the quarterly course registration. Failure to do so could result in selecting courses that fail to meet the requirements of the MS degree.

The MS Degree Program Director is the default initial academic advisor for all MS students. A student may elect at any time to change to a different academic advisor by these steps:

1. The student notifies the current advisor, and
2. In the Graduate Student Tracking System (GSTS), the student issues an ‘invitation’ message to the potential new advisor (purple menu bar at top; select ‘Committee’ tab, then visit the white/gray ‘Committee/Advisor’ tab and the ‘Send Committee Invitations’ tab with instructions), and
3. If the faculty member clicks the ‘accept’ link in the invitation email, then the GSTS will formally record the new advisor. If necessary, the CS Graduate Affairs Coordinator can assist with any GSTS difficulties.

3.2 MS Degree Plans

Each full-time student pursuing an MS degree in Computer Science (CS) must declare his/her intention to follow one of the degree plans summarized below and have that declaration approved by the Director of the MS program.

3.2.1 Plan A (Thesis)

In this plan, a student declares their intent to earn the MS degree by completing a formal thesis that reports substantial original research results. The thesis advisor must be identified when declaring this option. A second committee member should be found as soon as possible.

A successful thesis has two components: a written document and an oral defense of the research. These are judged by the thesis committee, headed by the thesis advisor.

Under this plan, a maximum of three units of COMP_SCI 590 research credit can be counted toward the 12-unit requirement for the MS degree.

3.2.2 Plan B (Project)

In this plan, a student declares their intent to earn the MS degree by completing a project and writing a project report that contains results based on existing theory and techniques or experimental verifications. The project advisor must be identified when declaring this option. A second committee member should be found as soon as possible.

A maximum of two units of COMP_SCI 590 research credit can be counted toward the 12-unit requirement for the MS degree.

3.2.3 Plan C (Course-only)

In this plan, the student must satisfactorily complete 12 graded courses approved by the student's advisor. The choice of courses must represent a coherent program of study that prepares the student for advanced work in a specific field. All requirements for the course MS degree must be satisfactorily completed before the end of the fifth academic quarter (typically Fall quarter of the second year).

No units of COMP_SCI 590 can be counted as a credit for a course-only MS degree, because it is not graded.

3.3 Committees

Every MS student has an examination committee to evaluate their work. There must be at least two committee members. At least one committee member must be part of the Graduate Faculty.

<https://www.tgs.northwestern.edu/about/for-faculty/graduate-faculty-membership.html>

- Plan A (Thesis): a CS faculty member must either be the primary (academic) advisor, or an equal co-advisor. The other committee member may be a CS-affiliated faculty member. Both must be Graduate Faculty.
- Plan B (Project): As with Plan A, but a CS Post-Doctoral Associate is acceptable as the second committee member or co-advisor.
- Plan C (Course-only): the default committee is the Director of Graduate Studies and the Director of the MS Program.

Use GSTS (<https://www.tgs.northwestern.edu/academic-policies-procedures/gsts.html>) to record your committee. It sends formal invitations and records accepted members as part of the progress-recording needed by the CS Department and TGS.

We encourage MS students to form their committees as soon as they establish clear goals for their research or project topic. With more time for your committee to help, an MS student can gain build lasting connections to industry and research communities, get more guidance on good habits in research, design, writing and publications, and establish broader collaborations through conferences, journals, scholarships, and employment opportunities.

3.4 Timelines

An MS student can complete the program in three quarters, taking four courses per quarter. Most MS students take three courses in one or more quarters, and complete the program in four quarters, typically Fall, Winter, Spring, and Fall. Students doing Plan A (thesis) or Plan B (project) may petition for up to two additional quarters to finish their research work, by submitting an Extension Request form, signed by the advisor, to the CS Graduate Affairs Office.

This form is available on the Forms and Documents page:

<https://www.northwestern.edu/international/student-visas/changes-in-visa-status/extending-visa-status.html>

International students may then need to request an I-20 extension through the Office of International Students and Scholars (OISS):

<https://www.northwestern.edu/international/student-visas/changes-in-visa-status/extending-visa-status.html>

A full-time student may declare their degree plan (Section 3.2) at any time but must declare no later than a month before the end of their 3rd quarter. This would be May 1st for students entering in Fall. A student who does not meet this deadline and does not successfully petition the CS Department for an extension, will be automatically required to do Plan C (course-only).

Plan A (Thesis) and Plan B (Project) students should allow ample time for thesis revisions your committee or advisor may require. The Registrar's academic calendar lists thesis defense deadlines for each quarter

<https://www.registrar.northwestern.edu/calendars/>

These deadlines vary. In Spring term, the Graduate School requires all thesis defenses to be completed ONE MONTH before the quarter ends. Deadlines in other quarters are not as early but be ready!

For details on the degree completion process, see Section 6.

4 Curricular Requirements

MS students must maintain full-time study (three or four courses) throughout their Computer Science degree programs.

<https://www.tgs.northwestern.edu/academic-policies-procedures/policies/general-registration-policies.html#fulltime>

4.1 Course Requirements

Twelve (12) units of graduate-level credits with letter grades, i.e., not P/N or S/U, satisfying the following constraints.

- At least six (6) COMP_SCI classes.
 - COMP_SCI 499 (independent study) and COMP_SCI 590 do not count as COMP_SCI classes in this sense.
- At most six (6) 12 units of courses outside COMP_SCI.
 - Such courses must be approved in advance by both the student's advisor and by the MS Degree Program Director for CS, if different.
- At least three (3) of the 12 units of credit must be at the 400-level or above.
 - COMP_SCI 499 can be used to satisfy this 400-level requirement, but not COMP_SCI 590
 - Advisor - approved non-COMP_SCI 400-level courses can also satisfy this requirement.
- At most three (3) credits of COMP_SCI 499.
- At most
 - Plan A (Thesis): three (3) credits of COMP_SCI 590

- Plan B (Project): two (2) credits of COMP_SCI 590
- Plan C (Course-only): zero (0) credits of COMP_SCI 590
- **No repeated courses except:**
 - COMP_SCI 497 (Design, Technology, and Research), COMP_SCI 499, COMP_SCI 590, TGS 512

All coursework for the MS degree must be taken within The Graduate School (TGS) of Northwestern University.

Coursework must be completed with a composite grade-point average of B (3.0) or higher.

MS students must consult with their academic advisor before enrolling in courses. Advising helps students avoid bad choices such as inapplicable or inappropriate courses, and courses that do not meet degree requirements.

Courses completed for undergraduate credit at Northwestern cannot be repeated for graduate credit.

4.2 General Registration Courses

An MS student on Plan A or B who has completed all course requirements but needs additional time to finish a project or thesis may register for TGS 512.

<https://www.tgs.northwestern.edu/about/policies/general-registration-policies.html>

A student registered in TGS 512 maintains student visa status, defers student loans, keeps their NetID, WildCards, and email accounts active, and retains access to most university facilities.

Students taking TGS 512 cannot enroll in any other courses. They must make steady progress towards degree completion in collaboration with their advisor.

The tuition for TGS 512 is \$100 per quarter. Students taking TGS 512 are not eligible for the TGS Activity Fee nor any of its attendant services.

Students taking TGS 512 are required to maintain their health insurance but do not receive the subsidy.

<https://www.northwestern.edu/student-insurance/students/the-graduate-school-students.html>

To enroll in TGS 512 requires formal approval from your academic advisor and the Director of the MS Program.

4.3 Course Credit Waivers

An MS student may petition to have at most three course credits waived, based on graduate level courses taken previously at another program. Only coursework that has **not** been applied to a completed graduate degree will be considered for transfer credit for a MS degree. A petition for such a waiver must include complete documentation (*e.g.* syllabus, assignments, projects) of the content of the graduate level course the student wants to transfer. The student must also provide an official transcript, sent directly to the department that shows the grade received for each course used for transfer credit.

The coordinator of this CS Department course will review the petition and make a

recommendation. All such waivers are ultimately subject to the approval of the advisor, the Director of the CS MS Program Director, and the CS Director of Graduate Studies.

5 Prerequisites

All MS Students in Computer Science (including BS/MS and BA/MS students) must provide evidence of having sufficient background in the field.

5.1 Northwestern BS/MS, BA/MS, and transfer students

- Must have completed the undergraduate CS core sequence (COMP_SCI 111, COMP_SCI 211, COMP_SCI 212, COMP_SCI 213, COMP_SCI 214) prior to beginning their Master's studies.
- Students who have not completed the core sequence will not be allowed to matriculate into the MS program in CS.
- A course taken at another university can substitute for a core class, only if it is accepted as transfer credit towards an undergraduate degree program at Northwestern University.

5.2 MS students newly admitted to Northwestern:

- Prior to their first quarter of study, MS students in Computer Science must take **the CS preliminary exam** covering topics in our undergraduate CS core sequence (COMP_SCI 111, COMP_SCI 211, COMP_SCI 212, COMP_SCI 213, COMP_SCI 214).
- The preliminary exam is offered only once per year in the week before *New Graduate Student Fall Registration* begins.
- It is the responsibility of the students to arrive on campus in time to take this exam.

The preliminary exam option is only available to newly admitted students.

6 Degree Completion

6.1 Degree Completion Process

To complete the MS degree, in their final quarter all MS students must

- ensure that their committee information in the Graduate Student Tracking System (GSTS) is correct
- upload the Intention to Complete form to GSTS
- complete the Master's Degree Completion Form on GSTS
- complete the Application for Degree (AFD) on GSTS
- (PhD students only): complete the Masters in Primary PhD Form on GSTS.

The Intention to Complete form can be found on the CS Graduate Forms and Documents page:

<https://www.mccormick.northwestern.edu/computer-science/academics/graduate/forms-documents.html>

Deadlines for the above steps can be found here:

<https://www.mccormick.northwestern.edu/computer-science/academics/graduate/announce-deadlines.html>

Deadlines for Spring quarter are quite early – about a month before the end of the quarter.

If the deadlines are not met, the degree cannot be awarded. A student will have to file the Application for Degree in the next quarter. A student in such a case who has met all requirements and filed everything else, does not have to register as a student to file the AFD. Additionally, prior to the awarding of a degree, such a student can request a Certificate of Completion if one is needed for some purpose, such as employment.

<https://www.tgs.northwestern.edu/academic-policies-procedures/policies/graduation-and-diploma-mailing.html>

6.2 Thesis Defense and Submission

A student doing an MS thesis must successfully present an oral defense of that thesis.

After the advisor and the committee has approved the thesis with any required revisions, the student must submit the thesis in its final form as a CS Department Technical Report. The thesis is not considered complete until this step has been taken.

<https://www.mccormick.northwestern.edu/computer-science/research/tech-reports/>

The MS thesis must conform to the formatting guidelines of a doctoral thesis, as specified by The Graduate School:

<https://www.tgs.northwestern.edu/about/policies/phd-degree-requirements.html>

There is no specified minimum or maximum length for a thesis. Historically, they tend to be roughly 30 to 50 pages in the double-spaced graduate school thesis format. The MS thesis committee evaluates the thesis contents for completeness and decides if the submitted work is of adequate length.

6.3 Project Report Approval and Submission

A student doing an MS project must successfully complete a written project report.

Optionally, the student may submit their project report as a CS technical report.

<https://www.mccormick.northwestern.edu/computer-science/research/tech-reports/>

We recommend, but do not require, that the written project report conforms to the formatting guidelines of a doctoral thesis, as specified by The Graduate School:

<https://www.tgs.northwestern.edu/about/policies/phd-degree-requirements.html>

There is no specified minimum or maximum length for a project report. The typical length is 20 to 40 pages. The MS project committee evaluates the thesis contents for completeness and decides if the submitted work is of adequate length.

7 Special Situations

7.1 Transfer

Our MS program has limited capacity. We cannot accept most requests to transfer into CS from other MS programs at Northwestern.

Any petition to transfer into the MS degree program in CS must be approved by both the Director of Graduate Studies for the student's current degree program and the Director of Graduate Studies for the CS Department. The student will need a strong recommendation from the current advisor, and we will confer with this advisor during the evaluation of the request.

Transfer is not guaranteed. If approved, **transfers may require one or more additional quarters of study**, and we will require evidence of good progress already made in the original degree program as we consider the transfer request.

Transfers to Computer Science must meet the program requirements for establishing appropriate background described in Section 7.1.

Transfer requests are accepted for review after the student has demonstrated success as evidenced by **at least one quarter of letter-graded work** in the current degree program and, at the earliest, transfer requests may be placed in the 2nd (typically Winter) quarter - to be effective starting in the 3rd (typically Spring) quarter of their first year.

A student should request a program transfer no later than the date by which the students declare their degree plan: May 1 of the academic year of their admission, at the latest. In exceptional cases, requests for transfers will be considered after this date, however, they will be subject to extra review by the student's advisor, the Graduate Committee, and the Director of Graduate Studies.

Students will not be considered for transfer until after they complete at least one quarter of letter-graded work in the program to which they were admitted.

Requests for program transfer should be signed by the students' academic advisor and submitted to the CS Graduate Student Affairs Office. It will be forwarded to the DGS for evaluation. The DGS will take various factors into account, including, but are not limited to:

- Success in the original program of study or track to which the student was admitted.
- The expected ability of the student to successfully complete graduate work in the desired program of study or track. Relevant evidence includes transcripts and work experience.
- The justification provided by the student for requesting a transfer. This justification must be more substantial than a simple desire to change the title of the degree.

7.2 Ad-Hoc Combined MS / PhD Degree

The Graduate School allows students in one PhD degree program to pursue a secondary MS in another program. The details are given here:

<https://www.tgs.northwestern.edu/academic-policies-procedures/policies/ad-hoc-combined-degrees.html>

Note that this must be applied for and approved by both departments in advance.

7.3 Part-time Enrollment

MS students must maintain full-time study throughout their Computer Science degree programs, i.e., **no fewer than three and no more than four course units of credit per quarter**, as defined by The Graduate School

<https://www.tgs.northwestern.edu/academic-policies-procedures/policies/general-registration-policies.html#fulltime>

Only USA citizens and permanent residents in the CS Master's degree programs be enrolled part time. The United States government does not grant student visas for part-time graduate study.

For more information, consult the Director of the CS MS Program.

7.4 Continuation to PhD

Students admitted to the MS degree programs in CS at Northwestern generally cannot enter the PhD programs in CS. The surest, most sensible path for entry into the PhD program is to apply to the PhD program itself rather than entering through the MS program. However, sometimes a faculty member may decide to formally invite a successful MS student to transfer into the PhD program. The faculty member must notify the CS Director of Graduate Admissions of this invitation before the CS department will consider a student's petition to transfer.

MS students are required to complete at least 2 quarters of classes in the MS-only program before they can be considered for a transfer into the PhD program. A student is planning to apply to continue with the PhD program must contact the CS Department Student Affairs Office (csgrad@northwestern.edu) to learn the correct process for this unusual transfer. Each student's case will be evaluated subject to the same procedures and standards that apply to external PhD applicants, but MS-to-PhD transfer students are ineligible for the first-year fellowships that ordinarily support new PhD students.

7.5 MS in Primary PhD

We recommend that students admitted to the PhD program apply for an MS degree as soon as they have fulfilled

- the course requirements for Plan C, OR
- the course requirements for Plan B and had their research work approved by a committee designated in GSTS, OR
- the course requirements, and successfully defended their research work before a committee designated in GSTS for Plan A.

For details on the requirements, see Section 4.1. To apply for the MS degree, see Section 6.1.

7.6 Academic Integrity

All students are expected to conduct their studies and research following the highest standards for academic integrity.

<https://www.tgs.northwestern.edu/academic-policies-procedures/policies/academic-integrity.html>

Students must be particularly vigilant in programming courses. Unless the instructor for the course has explicitly documented otherwise in the course syllabus:

- Code you submit must be your own.
- Copying and adapting someone else's code is not allowed.
- Studying someone else's solution for a specific assigned problem is not allowed.
- This includes code from a friend, an online article, or online code repository.
- Letting another student study your solution is not allowed.

If an instructor concludes that cheating has occurred, he or she will submit the evidence to your

dean for adjudication. Penalties for cheating will depend on the specifics of the case. They can range from loss of points on the assignment in question, a reduction in letter grade for the course, or even failure, in extreme circumstances.

8 Internships, CPT, and OPT

MS students who wish pursue opportunities for off-campus internships, service-learning projects, and engineering research projects can obtain assistance from the Engineering Career Development program within McCormick School of Engineering:

<https://www.mccormick.northwestern.edu/career-development/for-students/>

An MS student engaged in these activities can maintain full-time registration with no tuition by enrolling in one of the following courses (requires advisor approval):

- CRDV_411 Engineering Internship Program
- CRDV_412 Projects in Service Learning
- CRDV_413 Engineering Research Project

These zero-unit (0) courses carry **no tuition cost, but maintain full-time enrollment status** at the University during these approved activities. They allow only the S/U grade basis (Satisfactory/Unsatisfactory) grade basis. Full-time status is usually required for international students to maintain US visa status and for some scholarships. Registration in CRDV courses helps Northwestern administration, including TGS, record graduate student progress and track our students' efforts in external research collaborations.

International students who chose to take an off-campus internship must also apply and obtain Curricular Practical Training (CPT) authorization. "Off-campus" is defined as any internship that takes place outside of Northwestern University. For more information on CPT and post-academic work under the Optional Practical Training program, see the International Office website:

<https://www.northwestern.edu/international/living-working/student-employment/index.html>

9 Probation, Exclusion, and Appeal Processes

The Graduate School (TGS) may place a graduate student on probation for failure to meet academic integrity standards (*e.g.*, cheating on coursework), failure to meet all the requirements for academic progress (*e.g.*, maintaining a minimum of 3.0 GPA), or for failure to reach milestones related to project or thesis work. Students placed on probation by TGS receive an email or letter to formally notify them of probationary status, the reason for that status, the actions the student must take to leave probationary status, and specific deadline dates for those actions.

Despite its dire implications, probation is meant to be a strong motivation rather than a punitive action. It is a formal, top-priority alert that you must take immediate corrective actions to continue in your degree program. Most probation notices allow a student only one or two quarters to resolve the problem before dismissal, but a student may formally petition TGS for an extension by supplying suitable and convincing reasons. Failure to remove probationary status

before the deadlines given may ultimately result in exclusion from The Graduate School and the respective degree program.

Once a MS student is placed on probation, the CS department reserves the right to review the student's case and subject the student to additional requirements and penalties during probation as relates to their standing in the CS degree program including, but not limited to, loss of funding and/or exclusion from the CS graduate program. For more information on probation and appeal processes for probation, please refer to The Graduate School requirements for satisfactory academic progress:

<https://www.tgs.northwestern.edu/academic-policies-procedures/policies/satisfactory-academic-progress.html>