Graduate Degree Requirements

Duke University
Department of Computer Science

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Introduction

To earn a graduate degree in Computer Science, students must successfully complete a program of study including coursework and research project work. The programs are designed to allow students the flexibility to create programs of study that match their particular interests and needs, with the recognition that computer science is an evolving and interdisciplinary field. However, each student's program of study and progress toward the degree must meet specific minimum requirements. Some of the requirements are mandated by Duke University and its Graduate School, and others are mandated by the Department of Computer Science (CPS). The Director of Graduate Studies (DGS, *dgs@cs.duke.edu*) is responsible for monitoring satisfactory progress toward the degree and certifying completion of degree requirements to the Graduate School as a representative of the CPS faculty.

The purpose of this document is to define these requirements precisely so that students know what is expected of them. This document also specifies milestone deadlines that must be met to remain in good standing as a graduate student. Extensions are available under some circumstances, but this requires approval of the DGS and (in some cases) a dean. A companion document entitled *Addendum: Graduate Research in Computer Science* presents more detailed policies for research progress and milestones.

General Requirements

Prerequisites. Most entering graduate students have at minimum a grounding in the fundamentals of calculus, linear algebra, and discrete mathematics, and basic knowledge of data structures, assembly language, and one or more higher-level computer programming languages. Any student who lacks this background should discuss this with the DGS and a faculty advisor.

Research. Research work is required for every graduate degree. The University authorizes faculty to set standards and judge research contributions in each field and subfield. A faculty advisor supervises the research, and a committee of faculty evaluates the work and certifies satisfactory completion.

Advisors. Each student must designate an eligible faculty member who agrees to supervise the student's research work. Cultivating and maintaining a productive relationship with a faculty advisor is an important requirement for any graduate student. In particular, advanced Ph.D. students are typically funded from research grants controlled by their advisors.

The advisor must be named and approved before the end of the first year. Any of a number of circumstances may cause a student to change advisors. In this case, it is the student's responsibility to notify the DGS and to name a new advisor as soon as possible, and within six months at most.

Committees. The student and advisor designate a committee of authorized faculty members to evaluate research work and certify that it merits completing a milestone and/or awarding a degree. The degree requirements specify the minimum size and structure of the committee, the deadlines and prerequisites for forming the committee, and the options available to the committee in judging the work. The DGS must approve all committees.

University Regulations. This document incorporates key regulations of the Duke Graduate School, but other requirements are not presented here. These include specific deadlines to file to receive a degree in a given semester, and rules governing language proficiency and minimum and maximum periods of residency at Duke. Students should familiarize themselves with these policies on the Web at *www.gradschool.duke.edu*. In the event that any part of this document conflicts with Graduate School regulations, then those regulations shall apply at the discretion of the dean.

Integrity. Students are expected to maintain high standards of conduct and personal integrity, as discussed in the graduate school regulations. Academic dishonesty or misconduct may result in dismissal.

Definitions and Guidelines

Eligible graded credit. Course requirements are met by earning *graded credit* in *eligible* courses. Graduate courses taken at Duke are eligible. A maximum of two 100-level undergraduate courses taken at Duke may be eligible, with DGS approval. In some cases, *external* courses taken at other institutions may be eligible with DGS approval. For example, students may take courses at the University of North Carolina (Chapel Hill) or at North Carolina State University through inter-institutional registration, if the student is registered for an equal or greater number of course units at Duke.

Grades. To earn graded credit for an eligible course, a student must receive a "good" grade in the course. For graduate courses the received grade must be a B- or higher. For approved undergraduate courses, grades of B or better are acceptable.

Regular courses. Students must complete a specified minimum number of *regular* graduate courses. Most graduate courses approved by the faculty for repeated periodic graded offerings qualify as regular courses. This includes 200-level CPS courses including many offerings of CPS 296. Independent study and reading courses arranged for individual students do not qualify as regular courses. CPS 300 is not a regular course. Undergraduate courses do not qualify as "regular" for the purpose of meeting graduate degree requirements.

Computer science courses. A course is a *computer science course* if it has a Duke CPS course number. This includes all courses offered within the department or cross-listed by the department. Other courses require DGS approval to count as computer science courses.

Outside courses and related fields. The degree requirements specify minimum and allowable numbers of "outside courses". A course is an *outside course* if it is not listed within the CPS department, i.e., it has no CPS course number. Some courses offered by other departments and cross-listed within the department may also qualify as outside courses, with the approval of the DGS.

The outside courses used to meet a computer science graduate degree requirement must meet two constraints. First, they must be in a *related field*. Natural science, engineering, mathematics, linguistics,

economics, law, and business courses are related. Other areas may also be considered related with the approval of the DGS. Second, a student's outside courses and related courses are to be drawn from a single coherent area. This constraint is met if the courses are offered from the same outside department. Other circumstances require the approval of the DGS.

Public presentation. Completion of each research milestone requires a *public presentation* by the student before an approved committee. To qualify, the presentation must occur on the Duke University campus, must be open to the public, and must be announced at least one week in advance by arranging an e-mail posting to all CPS faculty and graduate students (e.g., *department@cs.duke.edu*, or *announce@cs.duke.edu* for dissertation defenses).

Masters Program

Area of concentration. Each MS student must declare an *area of concentration*. Typical examples of areas of concentration include systems, algorithms, artificial intelligence, and scientific computing. A student may declare an alternative area of concentration (e.g., security or computational biology) with the approval of the advisor and the DGS.

Course requirements. Each student must earn a total of 30 credits recognized by Duke University, including eligible graded credit for at least eight courses (24 credits) in computer science or a related field. The eight courses must include the following:

- four regular graduate computer science courses taken at Duke, two of which must be in the declared area of concentration;
- one Algorithms course taken at Duke (this requirement is waived if the student earns Ph.D. quals exam credit in this area, as described below);
- one Systems or Architecture course taken at Duke (this requirement is waived if the student earns Ph.D. quals exam credit in one of these areas, as described below);
- two outside courses.

A given course may satisfy more than one of these requirements. For example, a student could earn an MS with a concentration in systems by taking CPS 210, 220, 230, 216, any two other eligible computer science courses, any two eligible outside courses, and any six additional credits.

All entering MS students must attend and participate in the first offering of CPS 300 after their matriculation.

Thesis or project. Each MS student must complete a research *thesis* or *project* under the supervision of a faculty advisor and an approved committee. The student prepares a written report and defends the work in a public presentation before the committee The committee votes to accept the work as a thesis, accept the work as a project, or to fail the defense. An MS thesis must be formatted and submitted for publication to the Graduate School in accordance with their regulations.

The MS advisor is a member of the Duke graduate faculty who holds either a primary or secondary CPS appointment or is approved by the CPS faculty. The advisor chairs the student's MS committee, which normally includes at least two other members of the graduate faculty, and at least two committee members with an appointment in the CPS department. At least one of the committee members must hold an appointment in another department or be from outside the student's major area. The DGS and the Graduate School must approve all MS committees at least one week before the MS defense.

Registration. Duke University requires a continuous period of registration for the MS program. Full-time students must complete the MS within two years of matriculating in the program; part-time students must complete the degree within six years. MS students converting from the Ph.D. program may be required to register as an MS student for at least one semester with full tuition (12 credits).

Ph.D. Program

Breadth requirement. Students must earn *quals credit* for at least one designated course in at least four subject areas. The subject areas and their designated courses (*quals courses*) are listed below. Quals credit may be earned by passing a written qualifying exam for a quals course, typically given at the start of each offering of the course. Quals credit may also be earned by attending the course and receiving a *quals pass* as determined by the instructor, based on at least two proctored examinations during the course, including a final exam.

1. Systems (e.g., CPS 210)
2. Architecture (CPS 220)
3. Algorithms (CPS 230)
4. Computational Complexity (CPS 240)
5. Numerical Analysis (CPS 250)
6. Artificial Intelligence (CPS 270)

The subject areas chosen to meet the breadth requirement must include at least one of Systems or Architecture, and at least one of Algorithms or Computational Complexity.

Students normally receive at least three quals credits during their first year, and must complete the breadth requirement by the end of the second year.

Course requirements. To receive a Ph.D. degree, a student must register for six semesters of full-time study, and should earn eligible graded credit for at least eight courses (24 credits) in computer science or a related field. The courses must include the following:

- four regular graduate computer science courses beyond the courses used to meet the breadth requirement (quals); and
- two outside courses.

At least four courses must be regular computer science courses taken at Duke.

All entering Ph.D. students must attend and participate in CPS 300 during the first semester.

Research Initiation project. Ph.D. students should participate in research as early in their program as possible. The *research initiation project* provides a structure for the student's entry into research. The student defines and conducts a substantial research project under the supervision of a faculty advisor and an approved committee consisting of the advisor and at least two other faculty members, or other members approved by the DGS. The committee evaluates and certifies two required milestones:

- The *proposal* is a written project proposal and public presentation before the middle of the third semester.
- The *review* is a written report and public presentation before the end of the second year.

The project review milestone gives faculty an opportunity to evaluate the student's research development well before the start of the third year, when Ph.D. students typically transition to grant-funded research. The student and committee agree on the scope of the material covered in the review at least three weeks in advance of the review.

Teaching requirement. Each student must have at least one semester of teaching experience, most commonly in the form of a teaching assistantship.

Supervisory committee. Each student must nominate a set of faculty members who agree to act as the student's Ph.D. supervisory committee. The supervisory committee is chaired by the student's advisor and includes at least three other members of the graduate faculty. The advisor is a member of the graduate faculty who holds either a primary or secondary CPS appointment, or is approved by the CPS faculty. At least three of the committee members should have appointments in the CPS department. At least one of the committee members must hold an appointment in another department or be from outside the student's major area. The DGS and the Graduate School must approve all supervisory committees at least two months before the preliminary exam.

Preliminary exam. The preliminary exam is a University-mandated examination of the student's independent scholarship and mastery of an area of concentration. The student prepares a written report on a selected research area and gives a public presentation before an approved supervisory committee. The committee holds a closed session with the student covering research progress, ongoing research, and relevant material in the area of concentration. The committee and student agree on the scope of the student's preliminary examination at least six weeks before the scheduled examination.

The preliminary exam report and the committee certification of successful completion should be filed in the DGS office before the end of the third year, and must be completed before the end of the fourth year. Extensions beyond the end of the third year require approval of a dean. Before filing for a preliminary exam, the student must complete the Ph.D. course requirements, breadth requirement, teaching requirement, and research initiation project review.

Thesis proposal. The *thesis proposal* is a formal mechanism for the committee to review and approve the focus and scope of the dissertation. The candidate prepares a written proposal statement and presents and defends it in a public presentation before the committee. The proposal summarizes the objectives, scope,

and methodology of the dissertation research, and outlines expected contributions and their significance. The committee may agree to combine the thesis proposal with the preliminary examination.

Dissertation and defense. Each Ph.D. candidate must complete a doctoral dissertation and defend it in a public presentation before an approved supervisory committee. The candidate should be prepared to deliver the full dissertation to each committee member by an agreed method at least four weeks prior to the defense; minor modifications suggested by the committee may be incorporated after the defense. The dissertation must be formatted and submitted for publication to the Graduate School in accordance with their regulations.

The dissertation defense should be completed within two calendar years of the preliminary exam. The dean must approve extensions beyond four calendar years.